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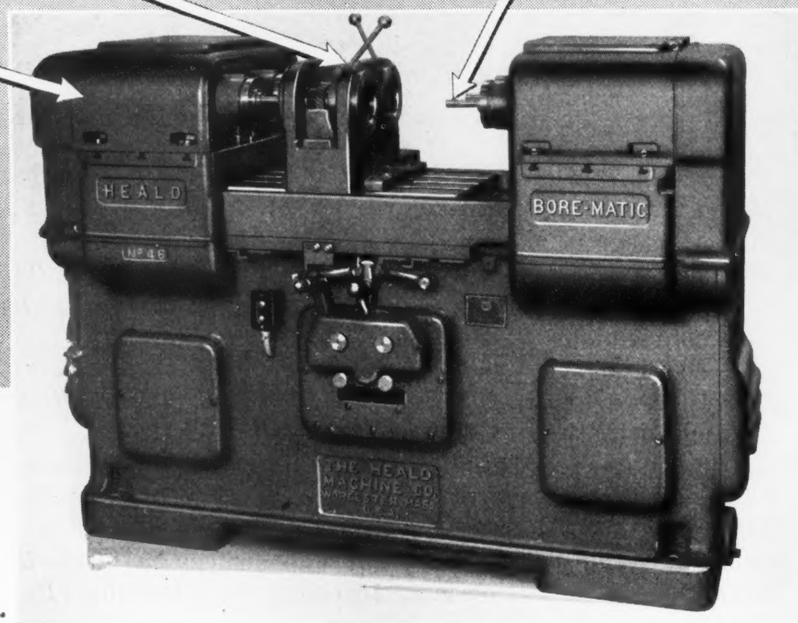
(1) The Machine (2) The Fixture (3) The Tool



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HEALD

MACHINERY

Volume 38 NEW YORK, DECEMBER, 1931 Number 4

Electrolytic Process for Making Metal Patterns

By CHARLES O. HERB

ELECTROLYTIC processes are used extensively in industry for plating one metal with another in order to improve the appearance or increase the wearing qualities. Little is known, however, of the possibilities of depositing metals on other materials by such processes.

A most unusual application of this sort has been developed by the Electro-Chemical Pattern & Mfg. Co., Detroit, Mich. This concern produces metal patterns by depositing copper electrolytically in plaster molds until a shell of substantial thickness has been obtained. Shells of this type are used for the molding surfaces of patterns and cores. The process is covered by patent.

Either wooden or metal patterns can be used as masters for producing metal patterns by this method. If wood is used, it should be either mahogany, cherry, black walnut, or some other hard wood that will not absorb moisture readily. Working patterns, whether of wood or metal, should be as smooth as possible, because the appearance of the patterns reproduced from them will depend greatly on the finish of the working patterns. Single-shrink master patterns are used for reasons that will be explained later.

Fig. 1. One-piece Cope and Drag Plates Produced by Depositing Copper Electrolytically on Plaster Molds

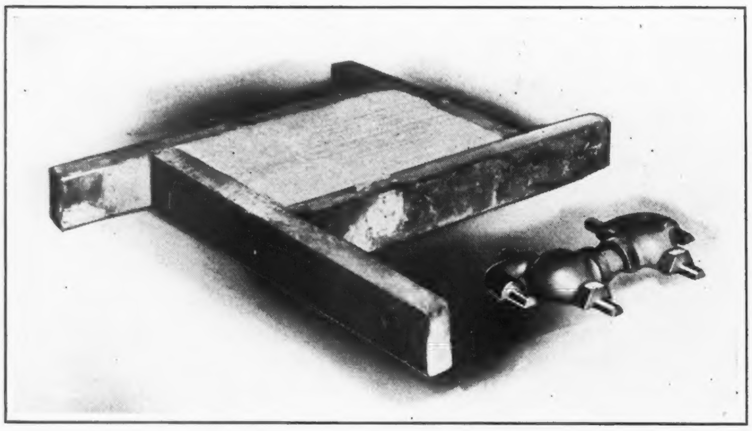


Fig. 2. The Plaster is Poured Over a Working Pattern Enclosed by a Wooden Form

The molds are made from a composite material resembling plaster-of-paris in wooden forms such as shown in Fig. 2. The size of the mold depends, of course, upon the dimensions of the pattern. The plaster composition is poured on the working pattern, which is laid on a surface plate within the wooden form. In this way, the mold is obtained with a true parting line surface. In Fig. 2, a working pattern is seen beside the mold.

After the plaster molds have solidified, the wooden forms are removed and the molds are thoroughly dried in the gas-heated oven illustrated in Fig. 4. They are next made waterproof and are also made resistant to the solution of the electrolytic bath, except in the mold cavities.

The Plaster Molds are Immersed in the Electrolytic Bath

The length of time that the plaster molds are suspended in the electrolytic bath depends upon how thick the copper shell is to be. This thickness usually ranges from 1/32 to 1/4 inch, and is governed primarily by the pattern design and dimensions. On the average, the molds remain in the bath four days.

When the molds are taken from the bath, the plaster is broken in pieces to release the copper shell. This shell is very smooth on the surfaces that were adjacent to the plaster and that will later be used for forming molds in sand. The inside of the shell, where finish and appearance are not essential, is somewhat rough.

The Copper Shells are Filled with White Metal

In order to give backing to the copper shells, they are filled with a non-shrinking white metal. Before this white metal is poured, brass inserts, such as seen at *X* in example *B*, Fig. 6, are positioned in the shell to provide a satisfactory means of attaching the pattern to plates for use in the molding machines. These inserts have grooves at the bottom, and are anchored in place by the white metal. They are later drilled and tapped. There is some expansion of the copper when the hot metal is poured in the shell, but in cooling, the shell contracts to its original dimensions.

After the white metal has cooled, the parting-line surfaces of split patterns are milled, as illustrated in Fig. 5, by the use of a two-fluted tungsten-carbide end-mill. To insure that the parting lines will be accurately machined in relation to the irregular contour on the mold side of the pattern, a second plaster mold is made for use as a jig during the machining operation. By using this jig as illustrated, it is easy to mill a parting line at the desired height from center lines and parallel with other surfaces.

When the milling operation has been completed, the pattern is ground on a disk grinder to remove any burrs and obtain a smooth finish. From 0.005 to 0.007 inch of stock is ground off, until the pattern reaches the specified height, as checked with a micrometer. Dowel-holes are then drilled in both faces of the split patterns and pins are provided. The patterns are then ready for fastening to plates for use in the molding machines.

While the preceding description has referred to patterns only, core-boxes are made by similar methods, except that while the plaster mold for a pattern consists of a cavity, the mold for a core-box stands in relief.

Large Cope and Drag Plates Made in Single Pieces

Cope and drag plates comprising single pieces are shown in Fig. 1. Plates of this type up to 38 inches square have been made by the methods outlined.

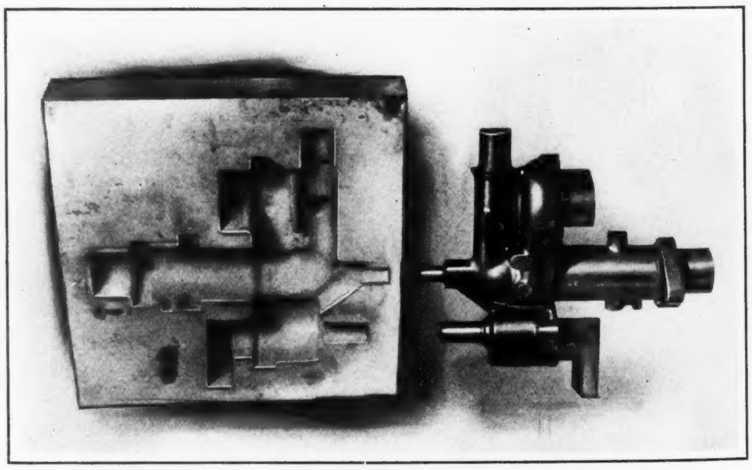


Fig. 3. Typical Plaster Mold and Working Pattern from which it was Made

Fig. 4. The Plaster Molds are Thoroughly Dried in a Gas-heated Oven before being Immersed in the Copper Plating Bath

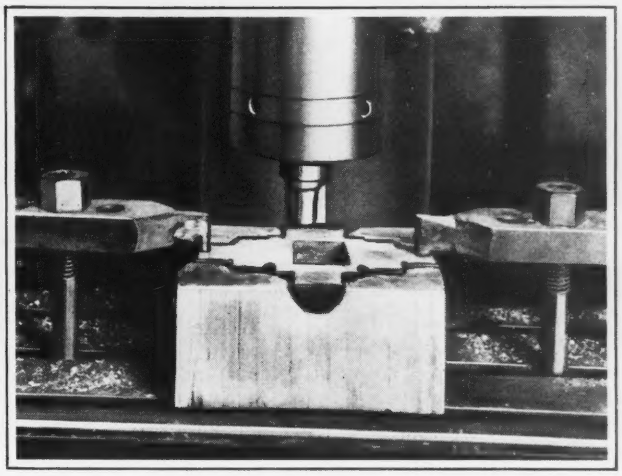


Fig. 5. A Plaster Jig with a Cavity Corresponding to the Contour of the Pattern Insures Accurate Milling of the Parting Line

Referring again to Fig. 6, the pattern at *C* is a handwheel of rather artistic design, which is quite a complicated piece for the patternmaker and molder. Example *D* is a pattern for a housing used on washing machines.

Why Single-Shrink Master Patterns Can be Used

When metal patterns are produced by the usual method, two shrinkages must be allowed for on the master pattern. This is necessary because shrinkage occurs not only in casting the metal pattern from the wooden pattern, but again when the work is cast from the metal pattern. In cases where a pattern made from brass or aluminum is to be used for making iron castings, there must be an aluminum or brass shrinkage allowance and also a cast iron shrinkage allowance.

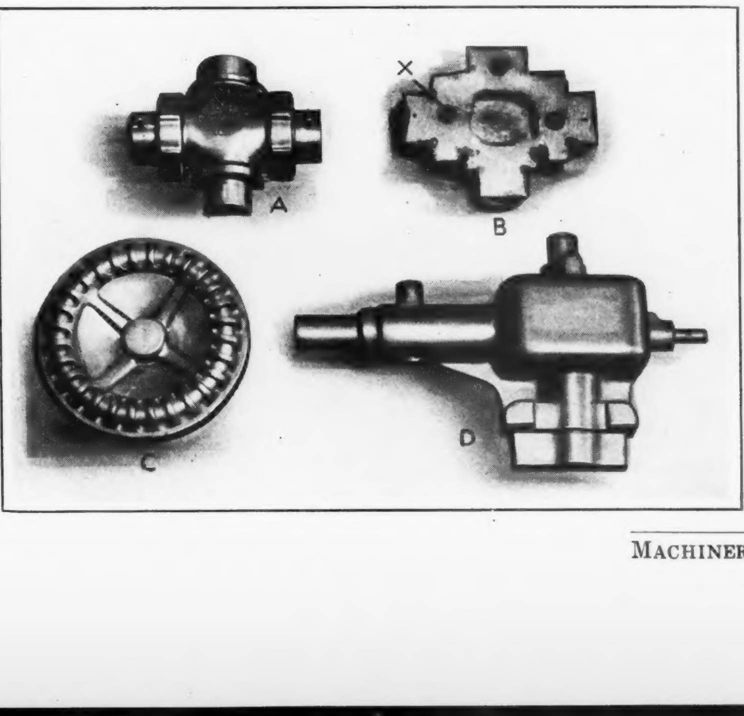
Master patterns used in the process here described have a single shrink allowance only, because shrinkage does not occur in making the metal pattern. Hence, allowance need only be made for the shrinkage of the castings made from the metal patterns. Because of this feature, patterns can be made electrolytically direct from metal patterns in use in the foundry, when additional patterns are required, or direct from experimental patterns.

Other Advantages of Electrolytic Patterns

Metal patterns made by the electrolytic process come from the plaster molds so smooth on the mold surfaces that scraping, filing, or other finishing operations are not necessary. They are accurate on all contours, whether regular or irregular. These characteristics, together with low cost, are the principal advantages obtained by depositing the copper on plaster. Another important advantage of these patterns is that copper possesses good wearing qualities for use as patterns in sand molds. It is claimed that these metal patterns can be produced to the required size within a few thousandths of an inch.

While the electrolytic process here described is well adapted to the production of split patterns, cope and drag plates, and coreboxes, "shell type" patterns cannot be made economically by this method.

Fig. 6. Typical Metal Patterns that are Produced by the Electrolytic Process Described



Methods Used in Fabricating Allegheny Metal

How to Obtain the Best Results in the Fabrication of 18-8 Chrome-Nickel Alloys, Including Such Operations as Turning, Grinding, Drilling, and Punching

THE trade name Allegheny metal is employed to designate an important alloy in the stainless metal group. The methods employed in welding Allegheny metal were described in July MACHINERY, page 875. The present article deals with the methods used in machining, punching, and forming this alloy. The article is based on information supplied by the Allegheny Steel Co., Brackenridge, Pa.

Allegheny metal has an ultimate tensile strength of 90,000 to 100,000 pounds per square inch, as compared with 45,000 to 50,000 pounds for ordinary mild steel, assuming that both are in the annealed state. It has an elongation of 60 to 70 per cent, as compared to an elongation of 30 to 40 per cent in mild steel, both being in the annealed state. It does not require a great amount of cold-working to increase the tensile strength of Allegheny metal to 120,000 to 125,000 pounds per square inch, whereas the same amount of cold-working would cause but a very small change in the physical properties of mild steel. The proper fabrication of the 18-8 chromium-nickel alloy depends primarily on an understanding of these characteristics.

Power Required for Shearing

It is very important that the knives used for shearing Allegheny metal be kept sharp and properly adjusted. Allowing a factor of safety for blades that are not properly adjusted, a machine for shearing this material should have about twice the power required for mild steel. If the blades are not closely adjusted, the metal will be drawn over the bottom knife and work-hardened before the shearing or cutting actually begins. Allegheny metal has to be cut through all the way, whereas mild steel breaks off after being cut from 27 to 75 per cent of the way, depending on the thickness being cut.

Close-Fitting Punches are Necessary for Best Results

About twice as much power is required for punching this material as for punching mild steel, and the punch must be a closer fit in the die. If the clearance is too great, the material will be drawn over the edge of the die, causing it to be work-hardened. This brings excessive strains on the tools and the press.

Although punches used for steel can be employed in punching Allegheny metal not thicker than 20 gage, it is desirable, and generally necessary, to have special punches and dies for heavier gages. A "neat fit" should be specified for these special punches. It is a real problem to perforate Allegheny metal with gang dies, because of the difficulty of maintaining the proper clearance, but it can be done if the press and tools are in condition to hold a very close adjustment.

In forming, as in the operations previously considered, adjustment of the machine is of vital importance. The dies may be set perfectly and yet, because of worn gibs, the punch may be forced off center, causing excessive "ironing" on one side of the piece. Frequent causes of unsatisfactory results are rough dies, the use of a drawing compound that is too light, and carelessness in operation. Pieces of metal that pile up on the draw-ring frequently cause breakage.

To overcome these difficulties, it is necessary, first of all, to have a machine that can be held in close adjustment to keep the punch from going off center. The choice of a drawing compound is the next consideration. A heavier compound than ordinarily used must be employed for Allegheny metal because of its high physical properties, which cause higher temperatures when drawing, due to increased friction. It is necessary to have a lubricant that is heavy enough to stand up under the higher temperatures, in order to prevent excessive wear on the dies.

Probably the best drawing compound for Allegheny metal is white lead, thinned with linseed oil to about the consistency of a 600W engine oil. Most of the standard drawing compounds will work satisfactorily, however, provided they are mixed to the proper consistency, which is about that mentioned for white lead. The drawing compound that adheres to the drawn piece must be removed before annealing to prevent it from burning into the piece during the annealing operation.

Points to Take into Account in Deep Drawing

The "flow" of Allegheny metal during the drawing operation is different from that of deep-drawn steel. The slower the press speed, the less work-hardening there will be and the deeper the draw that can be made in one operation. This is true of any metal, but is of especial importance in the case of this material which work-hardens rapidly.

A greater clearance can be used between the punch and die when deep-drawing Allegheny metal than when deep-drawing mild steel. This is just the reverse of the requirements for shearing and punching, and is due to the higher physical characteristics of this metal and the manner in which it "flows."

The draw-ring may be made with a larger radius than that used for mild steel, the radius varying, of course, according to the thickness of the metal, the press speed, the type of blank-holder used, and the shape of the piece. As with other metals, there

should be just enough pressure on the draw-ring to prevent wrinkling. The draw-ring and punch should be made with as large radii as possible, the radii being kept within such sizes as are required to prevent wrinkling of the work.

The pressures required on the blank-holder will be found considerably higher for this metal than for mild steel due to three reasons: (1) The higher physical characteristics; (2) the work-hardening characteristics; and (3) the use of heavier drawing compounds. The draw-ring should always be made of a good grade of tool or high-speed steel.

Practice in Drilling Allegheny Metal

A high-speed drill should be used for this material, with the point ground somewhat flatter than the standard. Lay-outs should be made with a triangular-nosed center-punch, taking care not to make the mark deeper than necessary, in order to avoid work-hardening and thus making it difficult to start the drill. On account of the work-hardening characteristics of Allegheny metal, it is necessary to exert sufficient pressure on the drill to make it cut all the time.

It is very important that this metal be properly backed up, because it does not chip or break out ahead of the cutting point of the drill, as does ordinary steel, and the drilling must be done all the way through. The speed of the drill should be about one-half that used for mild steel. Immersing the drill in water after each hole is drilled will prolong its life considerably.

The low-speed electric hand drills recently brought out by several manufacturers are much better for drilling this metal than the older types, in which the speeds were too high. The drill must be kept cutting when in contact with the work to prevent work-hardening. In drilling deep holes, a compound of one pound of sulphur to one gallon of lard oil will prove advantageous.

Speeds, Tools, and Lubricants for Turning and Threading Allegheny Metal

The turning of Allegheny metal is best done at about one-half the speed used for the same part in mild steel. The tool clearance angle should be similar to that used in machining dead soft brass, because Allegheny metal has the same tendency to drag. The tool must be kept cutting, because if allowed to ride, it will work-harden the material, making machining more difficult. This applies also to shaper work.

For threading, the best results are obtained with a tool similar to that used for dead soft brass. Taps should also be similar to those used for dead soft brass, but should be slightly more tapering, and, in addition, should have only two or three full teeth. Whenever it is necessary to use a lubricant, a mixture of 40 gallons of water, 10 gallons of mineral lard oil, and 2 1/2 pounds of 58 per cent soda ash (sodium carbonate) gives good results.

The cost of tool upkeep is likely to be about two to three times as great as for mild steel.

Choosing a Saw for Cutting Allegheny Metal

A high-speed saw blade with wavy teeth has been found to work best on this material. For sawing comparatively light gages of sheet metal, thirty-two teeth to the inch is very satisfactory. For heavier material, such as bars, etc., a saw with fewer teeth to the inch is more satisfactory. Care should be taken to follow the recommendations of the manufacturer of the saw blade, particularly with respect to the speed, as too high a speed may result in drawing the temper.

Method of Annealing that Gives Best Results

Allegheny metal requires a much higher temperature for annealing than most other metals. A temperature of between 1900 and 2000 degrees F. is recommended, but in no case should a temperature of 2000 degrees F. be exceeded. A muffle or semi-muffled type furnace gives the best results. In no case should the flame come in direct contact with the work. After thorough heating, the work should be cooled in the air, best results being obtained by rapid cooling. In the case of heavy sections, water-quenching is desirable.

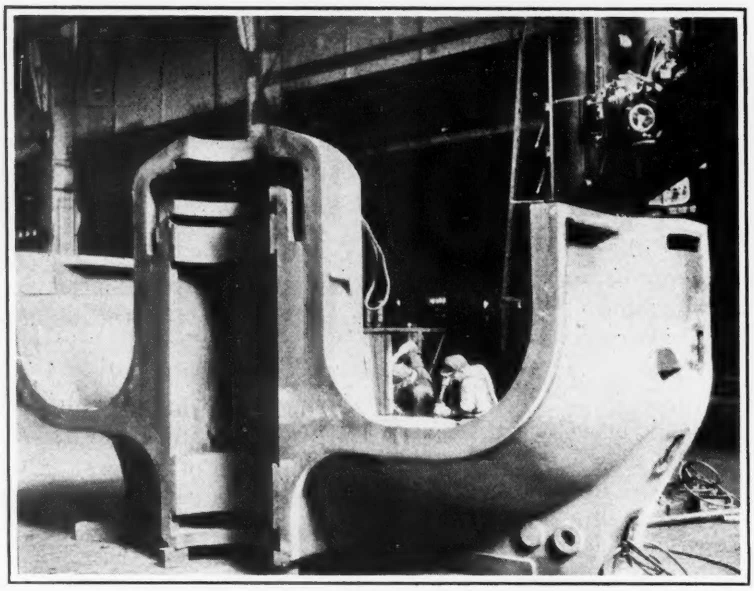
The time required for annealing depends on the thickness of the section. For example, light sections formed from 22- or 24-gage sheet stock would require not more than three to six minutes in the furnace, depending on the type of furnace used. A piece 1/8 inch thick may require twenty to forty minutes in the furnace, while a piece of 1-inch plate may require from one to two hours. For heavy sections it is desirable to heat slowly up to about 1700 degrees F. to prevent excessive oxidation of the piece, and then to bring the piece up to the required heat very rapidly. To prevent sagging or deformation, the piece should be well supported while it is in the furnace and while cooling. Rapid cooling is necessary, and in no case should the piece be allowed to cool in the furnace.

Recommended Pickling Methods

The pickling of Allegheny metal is best accomplished by the use of 6 per cent (by weight) sulphuric acid at 160 to 200 degrees F. without inhibitor. The acid does not entirely remove the oxide, but softens it so that it can be removed by scrubbing. It is preferable to agitate the work in the bath, although it is satisfactory to agitate the bath while the work remains stationary. After pickling, the work should immediately be washed in clean hot water, dipped into a 10 per cent (by volume) solution of nitric acid at 160 to 200 degrees F., and again washed in clean hot water.

Another pickling solution which acts a little more rapidly than the straight sulphuric acid is a 10 per cent (by weight) solution of sulphuric acid with 1 pound of salt added to every 6 to 8 pounds of acid, operated at 140 to 150 degrees F. Pickling in this solution should be followed by washing in clean hot water and a nitric acid dip, and another wash as previously described. Care should be taken not to over-pickle Allegheny metal.

In rough-grinding Allegheny metal, the temperature rise is considerable and care must be taken to see that the work does not reach a temperature that will cause distortion. For rough-grinding, Lyonite or emery, between 40 and 60 grit, may be used, and the grinding and polishing may be carried out to whatever degree is desired by using emery as fine as No. 200 mesh.



A Fair-sized Casting—the Lower Half of the Exhaust Hood of a 52,500-kilowatt General Electric Turbine. The Material is Cast Iron and the Casting Weighs 55,000 Pounds

Buffing is best done with green chrome rouge. In grinding welding beads, where a solid wheel is used, it is preferable to use a wheel that has a high surface speed and that is soft, free-cutting, and will not fill up. Allegheny metal, in common with all other metals, resists surface discoloration and corrosion much better when the surface is highly finished and free from superficial polishing marks.

* * *

Soviet Trade with Germany

According to Russian statistics, the Soviet Union placed orders in Germany during the first eight months of this year to a total value of approximately $180,000,000. This represents a monthly average of about $22,500,000, as compared with a monthly average of about $12,000,000 in 1930, and $9,000,000 in 1929. The Soviet Republics occupy first place in the machinery exports from Germany. During recent months, however, difficulties have arisen in placing Russian orders in Germany due to the fact that the German Government guarantee fund has been exceeded. Unless steps are taken to facilitate credit relations between the Soviet Republics and Germany, it is likely that there will be a decrease in Russian orders placed in Germany.

* * *

Molybdenum Cushions Protect Tantalum-Carbide Tools

A new method of applying carbide tips to cutting tools has recently been developed by the Ramet Corporation of America, North Chicago, Ill., and is now being used in many of the tantalum-carbide tools manufactured by this company. An insert of pure molybdenum metal is brazed between the steel shank and the tantalum-carbide tip. As molybdenum has almost the same coefficient of expansion as the tantalum-carbide alloy known as Ramet, the use of molybdenum inserts effectively prevents strains being set up or cracks developing in the cutting tips as tools cool after the brazing operation. Such strains as may develop between the molybdenum insert and the steel shank are entirely absorbed by the molybdenum, due to its great ductility.

Molybdenum inserts are especially desirable in tools where the carbide tips are long, thin, or of unusual shape, or where unusually severe conditions of operation are expected. In small tools, the tantalum-carbide tip is now often mounted on a shank of solid molybdenum.

* * *

Softening Hard Spots in Steel Castings

By A. B. HARVEST

A method of softening hard spots in castings and forgings in order to make them machineable was described in October MACHINERY, page 114. Another method was used successfully by the writer in machining a steel casting containing hard spots from 2 to 6 square inches in area.

When a hard spot was encountered by the tool, the position was carefully marked. The tool was then reground and set in position to continue the cut. A portable oxy-acetylene torch was next employed to heat the hard spot to a dull red, after which the machine was started and the cut continued. The torch was kept lighted and directed on the spot as the work passed the welder at a point in front of the tool. The hard spot was thus kept heated until completely machined.

When a finish-cut was required, the heating of the hard spot before it reached the tool was repeated, so that an even finish was obtained. Cutting through the heated material had no bad effect on the high-speed steel tool. This method of dealing with hard spots can be applied with very little lost time.

* * *

No firm can afford to keep a man who requires constant supervision.—*The Shop Review*

Steel Castings in Machine Tool Construction

Steel Castings with the High Tensile Strength Now Obtainable are being Used Advantageously in Machines Designed to Withstand the Strains Imposed by the New Cutting Metals

ONE of the results of the use of tungsten carbide, tantalum carbide, special steels, and other new materials in metal-cutting operations has been a tremendous increase in tool pressures, making it necessary that machine frames, tool-holders, follow-rests, bedplates, and other parts of machine tools subjected to heavy stresses be made more rigid. That cast steel possesses the rigidity required for this purpose is evident from the fact that its modulus of elasticity is approximately 30,000,000, while that of cast iron is only about 12,000,000. This indicates roughly that more than twice the thickness of section in cast iron is necessary to produce the same rigidity as can be obtained in plain carbon cast steel.

The stresses imposed on machine tool elements are, in some cases, more than double what they were a few years ago. Yet in many cases the design of these elements, and the materials used in their construction, remain almost unchanged. On investigation, it was found that the spindle post of a high-speed drill press with a 1 1/2-inch drill operating at a feed of 0.03 inch per revolution was subjected to a load pressure of nearly 6000 pounds. For stresses of this magnitude, a rigid material such as cast steel is essential to prevent misalignment and inaccurate work.

The standards for cast steel used in some plants are not representative of the cast steel being produced today. The designers and draftsmen in such plants who have not taken the trouble to look into the matter will be surprised at the advantages offered by the cast steels now available. The average physical properties of plain carbon steel for castings produced in a fairly typical Midwest foundry over a period of six months were:

Tensile Strength, 73,700 pounds per square inch;

Yield Point, 41,400 pounds per square inch;

Elongation, 27.5 per cent;

Reduction of Area, 39.5 per cent.

These properties are quite representative of 0.27 plain carbon cast steel.

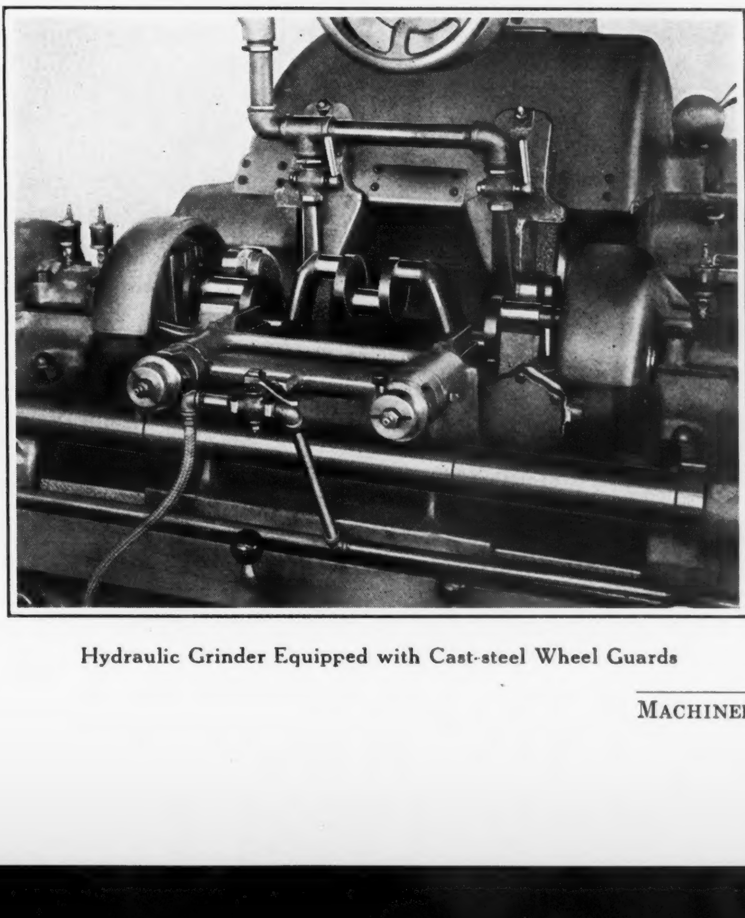
The physical properties of a low alloy cast steel possessing fair machineability being used extensively today for structural parts requiring high strength are as follows:

Tensile Strength	144,000 pounds per square inch
Yield Point	126,000 pounds per square inch
Elongation	14.5 per cent
Reduction of Area	37.5 per cent
Brinell Hardness	300
Impact Strength (izod)	13 foot-pounds

Another important problem, aside from the choice of materials, is to determine whether the machine tool part shall be integral or made up from a number of separate pieces welded or bolted together. If rigidity, high strength, good appearance, and economy of material are required, cast steel is the logical choice, as in most cases it meets all these requirements satisfactorily.

An interesting development in the use of cast steel was initiated recently by a well-known machine tool manufacturer in a new line of milling machines intended primarily for use with tungsten- and tantalum-carbide cutting tools. In these machines, a heavy cast-steel brace is used to tie the spindle quill to the double over-arms. This member, mounted at the extreme end of the spindle, provides a strong, stiffening support and does not affect the range of spindle adjustment.

The American Standards Association has recognized the dependability of cast steel by approving the inclusion of cast steel as a permissible material for grinding wheel hoods or guards for high-speed operations. The accompanying illustration shows cast-steel wheel guards applied to a hydraulic grinder. Steel castings are also being used for bearings and bearing caps of babbitt-lined bearings for grinding machines, as well as minor parts such as control levers. More and more the dependability of steel castings commends their use to designers.



Hydraulic Grinder Equipped with Cast-steel Wheel Guards

Making Electrically Welded Jigs in Russia

How Improved Box-Jig Bodies are Made in a Soviet Plant without Increasing the Cost

By WALTER WELLS

DURING the past year spent in Russia, the writer was impressed by the manner in which our production methods were being applied there, and in some cases improved upon, in the effort to obtain super mass production. The Soviet engineers want dies, for example, that will complete a job in one operation, and they will go to considerable expense to produce dies of that kind. Only reluctantly do they yield to the idea of making and using simpler dies temporarily until the product has proved satisfactory. Perhaps they are nearer right than we think. We always exercise caution because we are afraid the product will not sell, whereas that is something that they do not have to be afraid of, because they have no competition within their own borders.

The manner in which electric welding was used in the construction of box-jig bodies at one large plant indicates the facility with which they apply such methods as described in October and November MACHINERY, pages 108 and 171, respectively, and how they originate new and improved methods for such applications.

In the tool-room of this particular manufacturing plant, a box jig had to be made in a hurry. There was no time to cut out a pattern for the jig body or to make a casting, so the sides and the bushing plate were quickly shaped from flat cold-rolled stock and lightly pinned and screwed together, using triangular-shaped pieces of flat stock for ribs. When all these parts were snugly located, the joints were electrically welded.

This first electrically welded jig was quite a success in itself, but the experience gained in its manufacture suggested a number of innovations that could be used on future jigs. For one thing, standard sides with legs could be shaped or cut out in lots. Also, the triangular rib pieces could be made up in lots without wasting stock. These and several other improvements were adopted. With few exceptions, box jigs are now made this way in that plant.

A welding jig for clamping the parts together without taking the time to put in small screws and pins was added to the equipment. Then it was found that the bushing holes could be located in the flat plates before assembly. Now it so happened that the specifications of this particular factory called for pack-hardened jig plates and jig bodies, wherever possible. As long as the box jigs were made from castings, this could not be done; but now that cold-rolled and hot-rolled stock was being used, there was a good opportunity to incorporate this feature and thus produce a jig that could stand rough usage.

The bushing holes are finally located in the bushing plate after pack-hardening. One of the great advantages of the welding method is that the hardening can be done "in the flat," for the real advantage, after all, is that the method permits of building a sturdy pack-hardened jig body. The welding is a means to this end.

The bushing plates were generally made of 5/8-inch stock, although other sizes were used according to the size of the largest bushing and the nature of the drilling to be done. The sides and ends were made of 7/16-inch stock, except when they, too, contained drill bushings, in which case they generally were made of 5/8-inch stock. The rib pieces were 3/8 inch thick. (The metric system of measurements is, of course, used in Russia; the dimensions here given are approximations in the English measure.) If, for convenience in locating a stop-piece, it was found desirable to secure a side by the use of dowels and screws, this method was employed.

In boring out the bushing holes, the first location from the sides of the bushing plate does not need to be exact, because the sides and ends still remain to be bored. As an aid in making further locations, a 1/4-inch hole was bored in the plate above the spot where the sides were to join, and in line, each way, with one of the bushing holes. This made four holes in the plate, one near each edge. These holes were then transferred accurately to the proper plates on the sides and ends, after which a ground pin was fitted into each of these holes in the sides. The sides and ends could now be bored out, using the pins as the registering point one way and coming down the proper distance from the butt end the other way. Whatever time was spent in fitting the pins was about equivalent to the time formerly spent in indicating a locating surface on the inside of a cast-iron box. The squaring and paralleling of the sides and top, and the precision location of all holes in these members was not affected by the welding process.

How Parts are Machined and Assembled for Welding

All pieces that were required to be square and to have parallel sides were machined while flat. The triangular pieces were a great help in squaring up the sides, provided the 90-degree angles were all true. Of course, the assembly was positively pinned, screwed, or clamped together. In other words, the jig body was in its final assembled position before the welding was done. Then the checking up of the jig upon completion showed the holes to be located within accurate limits. Obviously, the strength of a welded jig body constructed as described is superior to that of a cast-iron jig body.

Jigs of Sheet Aluminum Facilitate Handling

Aluminum jig plates and jig bodies were also experimented with in an endeavor to make medium sized jigs light enough to permit them to be readily handled by a crew of girls in the production department. The parts to be drilled were all aluminum, and it seemed unnecessary to locate the parts in a heavy iron jig. Aluminum castings were tried for the jig construction without much success, due chiefly to the fact that the aluminum castings did not work up well in the tool-room. Also, the engineering department did not believe that they would stand up, so aluminum sheet stock was used.

The parts were machined in the "flat," as was done with the steel plates, allowances being made for the peculiar action of aluminum when welded. So far, two jigs have been made in this manner, and they appear to be quite a success, particularly because the drill bushings are on two sides as well as the top. Thus considerable weight is saved, which is appreciated by the operators who must move the jigs around continually or tip them over for drilling operations on opposite sides.

In an article dealing with the industrial developments of Russia, it may not be out of place to refer briefly to the question that has often been raised as to the ability of the Soviet workmen to operate, or effectively employ, the machinery and equipment imported from America and other countries. To this, the writer would say that the young Soviet apprentices are unusually bright and eager to learn. In this respect, it is interesting to compare them with the typical apprentices of our own country. The three years of excellent training that the Soviet apprentices receive are sufficient to turn out very good mechanics.

* * *

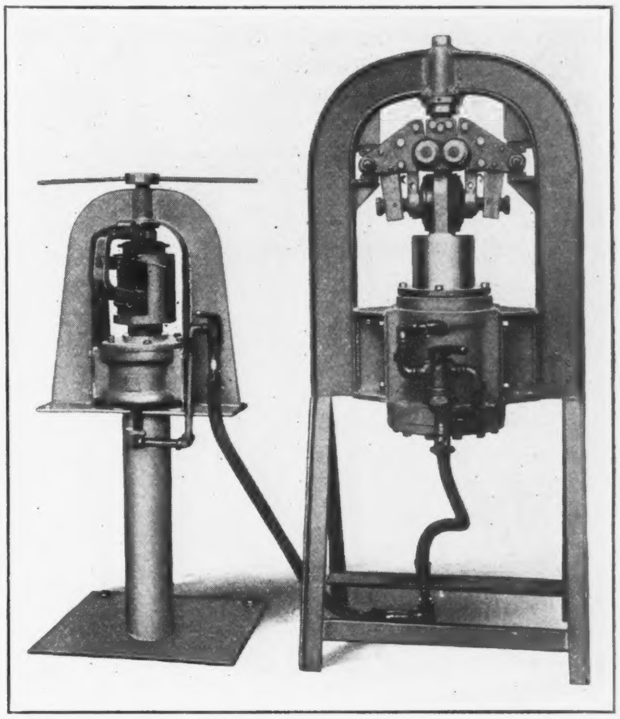
Misuse of the Word "Engineer"

In an article published in *The American Engineer,* D. B. Steinman, president of the New York State Society of Professional Engineers, refers to the misuse and abuse of the designation "engineer." The Society has started an active campaign to persuade individuals and corporations to discontinue using the terms "engineers" and "engineering" except where these terms actually apply, and has received a great deal of support in these efforts. Such designations as "plumbing engineers," "amusement engineers," "decorating engineers," "fumigation engineers," and "radio service engineers" have in several instances been effectively stopped. Contractors, architects, and salesmen who are not engineers have frequently appropriated this title to themselves. The use of the word "engineer" to designate men other than those who have received proper training in engineering tends to create confusion and misconception in the public mind as to the real work of the engineer; there is no more reason why unqualified men should freely use the title "engineer" than the title "doctor."

Arc-Welded Hydraulic Presses

The two special hydraulic presses shown in the accompanying illustration are of arc-welded construction. They were designed and built by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, for pressing ball bearings into the yokes of Cleveland tramrails. The welding operations were performed with equipment manufactured by the Lincoln Electric Co., of Cleveland, Ohio.

The frames of the presses are fabricated of steel shapes, arc-welded in place. The inverted U-shaped frame of the larger press is composed of two pieces of 4-inch I-beams, joined by arc welding at the top



Hydraulic Presses of Arc-welded Construction

to a boss of heavy steel tubing. The brackets that connect the cylinder of the ram to the frame and those that support the operating mechanism are of steel plate fabricated by arc welding. The saw-horse type base is composed of structural angles, welded to the frame and to each other.

The frame of the smaller press is fabricated of steel plates assembled by arc welding. The pedestal-type base was made by welding a square piece of heavy plate to one end of a 5-inch steel pipe.

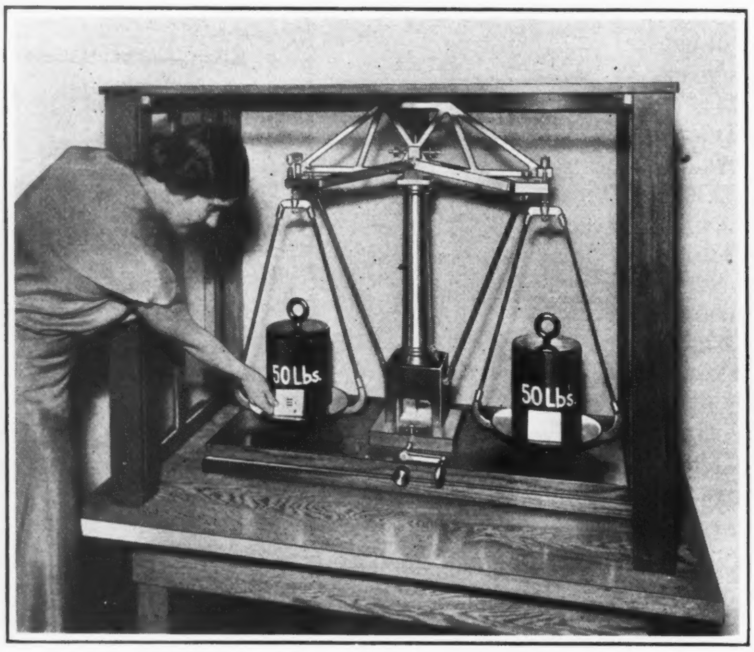
* * *

Surgical Tape for Mending Drawings

Mending torn drawings or tracings with surgical adhesive tape, preferably 1/2-inch wide, has been found by the writer to be superior to using the customary gummed paper. The rubber tape does not peel or curl off. It is flexible, and therefore has an unusually long life. Because of the fact that it is opaque, however, this tape can be applied only to tears in blank parts of the drawing. W. S. B.

Notes and Comment on Engineering Topics

An interesting survey on the wear of cast iron has recently been published in a bulletin issued by the British Cast Iron Research Association, 24 St. Paul's Square, Birmingham, England. It is stated that tests made in Germany, using a brake-drum type of apparatus, showed that in the case of the ferritic irons tested, the wear was decreased about one-half when the phosphorus content was increased from 0.25 to 0.7 per cent. Further increase in phosphorus, however, did not improve the wearing qualities. With the pearlitic series, the initial wear of the low-phosphorus irons was about one-half that of the ferritic irons of similar phosphorus content; but there was no appreciable reduction in wear until the phosphorus content reached from 1.3 to 1.4 per cent, when a decrease in wear of about 25 per cent was recorded. Italian investigations show that cast iron containing about 1.5 per cent of molybdenum has remarkable wear resistance.



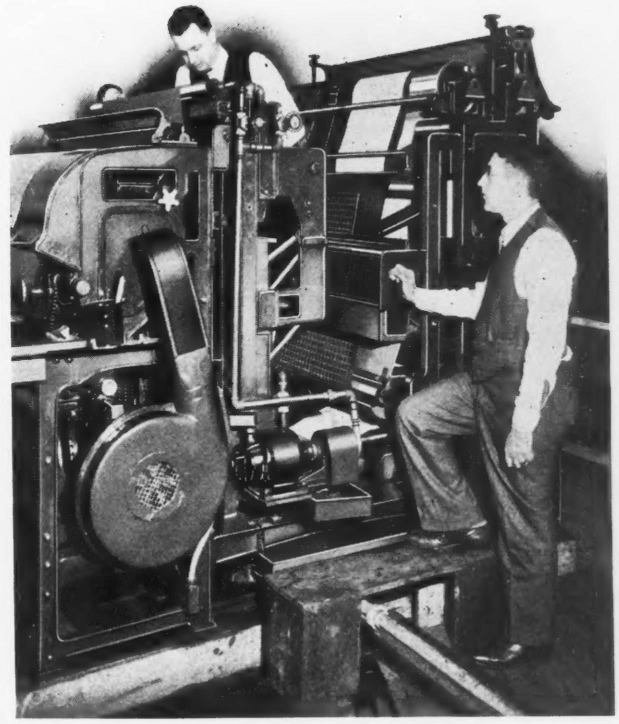
A scale in the electric meter and instrument laboratory of the General Electric Co. at Lynn, Mass., which will weigh objects up to 50 pounds, is so accurate that three pencil marks each 1 1/2 inches long, weighing but 35 millionths of an ounce, will affect the balance. This scale is believed to be the most accurate heavy balance in the country.

A new application has been found for the photoelectric tube—the electric eye which is sensitive to changes in the intensity of light. A machine has been designed by Hammerslag & Tinkham of Grand Rapids, Mich., working in conjunction with the General Electric Co., for inspecting and sorting beans as they pass on their way to be packed. As long as white beans pass in review, the eye of the machine is unaffected; but the appearance of a dark bean causes the relay to operate and a metal finger reaches out, deflects the bean, and causes it to drop into a separate container.

In a paper read before the Society of Automotive Engineers at its recent meeting in Washington, Colonel George A. Green, vice-president in charge of engineering of the General Motors Truck Corporation, outlined the economic possibilities of the Diesel engine as applied to heavy-duty vehicle operation. Extensive tests have been made with Diesel engines in trucks, and it is possible that in the future this type of engine will become an important factor in motor truck design.

Wind tunnel tests have shown that with the conventional railroad car operating at speeds between seventy and eighty miles per hour, more than 70 per cent of the total power required for moving the car is consumed in overcoming air resistance. Approximately 20 per cent of the power required to propel a new type of streamline car introduced by the Philadelphia & Western Railway Co. in the Philadelphia suburban service will be saved at speeds above sixty miles per hour by a design that greatly reduces the air resistance. Similar savings are possible by streamline automobile design.

Is Your Blueprint Room Up to Date?



Does it Operate Economically and Supply Good Legible Prints that Last?

By C. A. GREEN, Chief Engineer, and
H. J. BRUNK, Superintendent
The C. F. Pease Company, Chicago, Ill.

GOOD blueprints are just as essential to the machinist or toolmaker as good tools. Lacking either, his work is sure to suffer. Unfortunately, some concerns look upon the blueprinting department as a necessary evil. They provide inadequate blueprinting equipment and employ cheap labor to run the department—and still expect satisfactory results.

If the best possible blueprints are to be obtained at economical costs, the department should not only be equipped with modern printing, washing, and drying facilities, but also be manned with responsible men—men who will be able to get the best blueprints from different kinds of tracings by understanding the individual requirements, and who will take proper care of the equipment.

Another point that executives should remember is that a clean, convenient, and safe blueprint room is just as economical as an untidy, poorly arranged, and unhealthy department. Good prints cannot be made with obsolete or neglected equipment.

Selecting the Equipment for a Small Blueprint Room

In determining the type of equipment to be installed in a blueprint department, careful consideration should be given to present and future requirements. Present requirements may be small and warrant only the purchase of a vertical printing machine of the type seen at the right in Fig. 2, together with separate washing and drying machines. However, if future requirements are likely to be large, it is usually advisable to install a continuous automatic printing, washing, and drying machine such as shown in Fig. 1, or at least the printing unit of this type of equipment—a horizontal motor-driven printer.

Many small shops find the vertical machine sufficient to meet their needs, as a 42- by 60-inch size enables from 600 to 800 linear yards of paper to be printed per month. The machine illustrated is provided with a full glass cylinder, but smaller capacity machines are obtainable with only a half glass cylinder. The smaller type is popular for instruction purposes in schools and colleges.

Vertical machines such as shown are equipped with an electric arc light of about 1450 watts, which is suspended from the top and which drops by gravity the entire height of the glass cylinder. After tracings and blueprint paper are placed on the glass cylinder as shown in Fig. 2, the heavy canvas cover is tightened on them, as illustrated in Fig. 3, to hold the tracings and paper from slipping. An important advantage of the vertical type of blueprinting machine is the small floor space occupied.

It is more convenient to use a small roll of printing paper with this machine and to place as many tracings as possible on the paper at one time, rather than to use a single sheet of paper for each tracing. The difference in the cost of a small roll of printing paper in comparison with the cost of trimmed sheets generally pays for the time involved in trimming the prints to the required dimensions after they are finished.

The vertical tank seen at the rear in Fig. 2 provides a convenient means of washing the prints, applying a bichromate of potash solution, and thoroughly rinsing. Each print is suspended in such a way as to permit water coming from a horizontal pipe extending along the top of the tank, to run down over the entire print. While the print is suspended, the operator applies the potash solution by means of a wide brush, as shown in Fig. 3, the solution being contained in a small box-like com-

partment at the front of the tank. There is a similar compartment to hold another brush for the "hypo" solution required in making negatives.

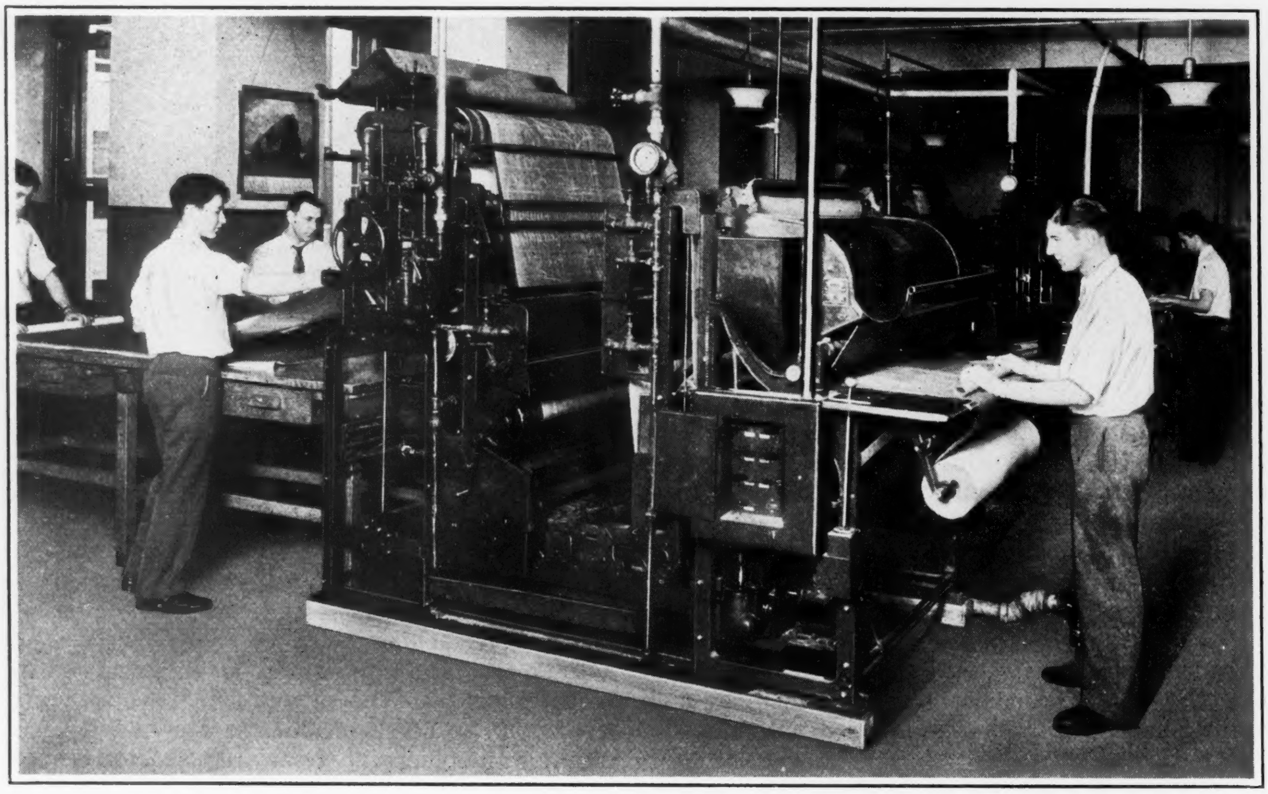
With this means of applying the potash solution, the blueprint man is in no danger of contracting potash poisoning of the arms and hands, which is common when it is necessary to reach into a tank of the solution to withdraw the prints. With a washing and rinsing tank such as shown, the blueprint man never reaches into other than pure water. Another advantage of this type of equipment is that a single tank takes the place of the three or four sinks required when the prints are laid flat in washing, potashing, and rinsing baths. Still another advantage of the vertical rinsing tank is that the prints do not become mottled, as is frequently the case when a number of them lie on top of each other in a flat sink.

If a drying machine of the type shown at the left in Fig. 2 is employed, there is no danger of wrinkled prints with curled edges. These dryers can be arranged to be heated either by electricity or gas. The particular one shown has a capacity of about 8 linear feet of printed paper per minute. It is motor-driven, and dries blueprints, negatives, and blue-line or brown-line prints perfectly flat and smooth.

A blueprinting department such as shown in Fig. 2 can be run by one man if a small roll of printing paper is used. While the prints are being exposed in the vertical printing machine, the man has time to wash and dry the prints previously made.

High Production Obtained with Automatic Machines

When the quantity of prints required exceeds the capacity of the vertical equipment, it is generally advisable to install the type of machine that automatically carries the blueprints through the printing, washing, potashing, rinsing, and drying operations. With this type of machine, the work of the operator consists merely in feeding the tracing on a continuous roll of paper and changing the speed of the machine to suit inked or penciled tracings, etc. The prints are automatically rolled up for trimming later or boys at the opposite end of the machine can cut off and roll up the dried prints as soon as they are made, as shown in Fig. 1. Equipment of this kind is available in different widths and capacities. The speed and methods of washing and drying vary in different machines.



Courtesy Fisher Body Corporation

Fig. 1. Continuous Type Blueprinting Machines that Carry Prints Through Printing, Washing, Potashing, Rinsing, and Drying Operations

With equipment of this kind, it is especially important to have an intelligent operator, who will fully realize the investment in the equipment and give it the care that an expensive machine in the shop would receive. Obviously, it would be futile to buy such a machine and then put it under the charge of a boy or incompetent man who might neglect to oil the bearings, to replace the carbon sticks, or clean the globes. Under such supervision, the machine would deteriorate and require repairs that would otherwise be unnecessary. Real care of blueprinting equipment is usually insured if the shop superintendent is given charge of it.

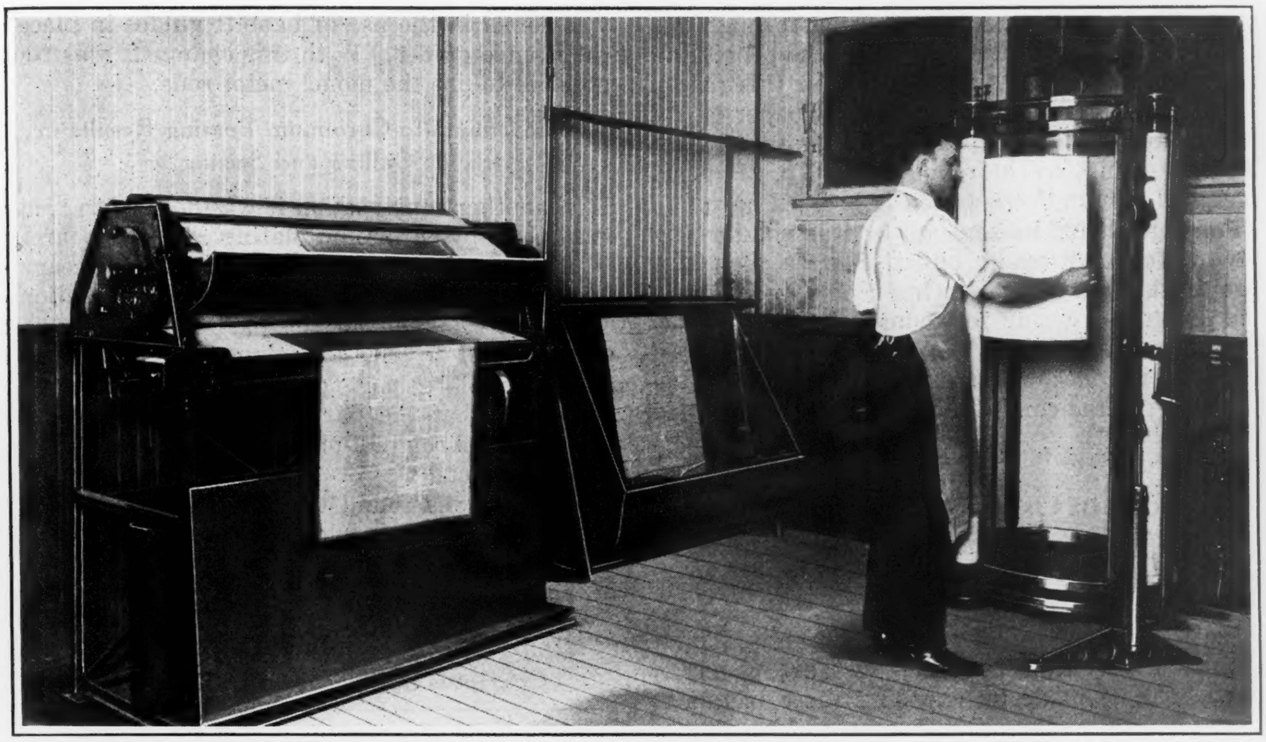


Fig. 2. Compact Arrangement of Blueprinting Equipment which Meets the Requirements of the Smaller Industrial Plants

The C. F. Pease Co. has recently developed a new process of blueprinting and blue-line printing that differs substantially from conventional practice. In this process, the printed paper, immediately after being exposed, is fed through stainless steel rolls coated with a chemical solution known as "Kyano." Then the printed paper passes through a spray-jet wash and direct to the drying unit of the machine without having to pass through the potashing unit. In fact, the omission of the potash application is recommended.

An important result of this process is that the blues do not run into the whites. Consequently on blueprints, the lines are pure white and sharp, while on blue-line prints, the lines are dark blue and there are never blue blotches in the white background. "Blocking out" is never required. The blueprints are of a deeper and richer blue than is ordinarily obtained.

Fig. 3. Applying Potash Solution in Vertical Type of Rinsing Tank without Danger of Potash Poisoning

Pease continuous-type blueprinting machines can be equipped for this process by the simple application of a tank with the necessary rolls, as shown in the heading illustration. [The process itself is more fully described in an article that appeared in November MACHINERY, page 223.]

After all, good blueprints start in the drawing-room, because poor tracings will never make satisfactory prints. If any considerable number of prints are to be reproduced from a tracing, the tracing should always be inked in. It is false economy to save a few dollars in the drawing-room and then lose money whenever the blueprint is referred to in the shop.

Pencil tracings should be made with lines heavy

enough to prevent light from passing through during the printing. At the same time, the pencil lines should not be so soft as to smear. For this reason, it is usually desirable to use a tracing paper of uniform texture. Bond paper of medium weight, say 12 or 13 pounds to the ream, and a No. 2H pencil give good results if the pencil is pressed hard.

Tracings should be kept as clean as possible, not only while being made, but also after they have been finished. In some drawing-rooms, each draftsman or blueprint man to whom a tracing is issued must sign a slip for it. When the tracing is returned to the files, the man who has used it is responsible for the condition in which it is returned.

* * *

Precautions in Using Stainless Steels, Monel Metal and Chromium Plate for Bearings

By GEORGE A. LUERS, Washington, D. C.

The merits of stainless steels, chromium plate and monel metal in resisting rust are generally known. Tests made by exposing these metals to the natural elements, acids, fumes, and salt water will show excellent corrosion-resisting properties. The action of these metals, when applied to machinery and operating parts of mechanisms, however, cannot be determined readily by tests, and comparatively little data is available on this subject. Referring to the accompanying table it will be evident that these metals cannot be depended upon to give reliable service in parts that are in frictional contact. Stainless steel is generally unreliable when used where the parts must slide or rotate freely without seizing, galling or "picking up." Chromium-plated parts, without exception, are unreliable for such service and monel metal will frequently be found unsatisfactory.

Fitting Stainless Steel to Monel Metal Results in Galling

In one application where resistance to rust was an important factor, the writer specified a stainless steel worm and a monel metal shaft. The stainless steel worm galled on the shaft while being fitted and a 40-ton press was required to take it off, even though it was machined for a normal push fit. In this instance a phosphor-bronze worm was substituted for the stainless steel worm which had failed to assemble properly, even with the customary white lead and oil lubrication.

Babbitt Guides for Monel Metal Part Eliminate Trouble Experienced with Bronze Guides

In another instance, monel metal rods were required to slide at a speed of 15 feet per second in bronze guides, the pressure being very light. The monel metal invariably "picked up" the bronze after a short time. Bronzes containing a large percentage of lead were substituted without any change in the results. After trying a variety of lubricants in an attempt to correct the trouble, the solution was found in the use of babbitt guides in place of the bronze guides. With this change it was found possible to use the monel metal rods.

Chromium-to-Chromium Bearing Results in Galling and Seizing

In another construction it was decided to protect steel parts by chromium plating. This appeared to be a simple, inexpensive and expeditious means of protecting the parts against the corrosive action of salt water. When all the parts were plated, assembled and tested, a seizing and galling of the chromium-plated parts occurred. Needless to state, we found that the parts simply would not work where two chromium-plated surfaces were in frictional contact.

When it was found that giving the plated surfaces a high polish would not prevent seizing, it was decided to test out stainless steel bushings for the bearings. The stainless steel bushings were made up and tempered. In the test, a repetition of the previous galling occurred. The parts of the mechanism which were in contact with the chromium, were then cadmium plated. The latter bearing, consisting of the two different metals, gave very satisfactory results with no evidence of the galling previously experienced. In the instances where stainless steel bushings were used, seizing was eliminated by substituting bronze bushings.

This summary of experiences and results obtained with the different metals is given for the benefit of those who would profit by the mistakes of others. These metals do not act as we would expect them to when used for parts in frictional contact and it is well to exercise caution when considering their use in a machine or mechanism.

Results Obtained with Bearings when Frictional Contact is Between Two Different Metals

Two Metals in Frictional Contact	Results*
Stainless Steel and Monel Metal	Seizes
Stainless Steel and Bronze	Fair
Stainless Steel and Babbitt	Best
Monel Metal and Stainless Steel	Seizes
Monel Metal and Bronze	Seizes
Monel Metal and Babbitt	Best
Chromium Plate and Chromium Plate	Seizes
Chromium Plate and Steel	Seizes
Chromium Plate and Cadmium Plate	Fair for limited use
Chromium Plate and Bronze	Good
Chromium Plate and Babbitt	Best

*Stainless steel and monel metal both show satisfactory resistance to fresh and salt water, and chromium plate is satisfactory if not adjacent to copper alloys.

* * *

It is reported from the laboratories of one of the large electrical companies that very interesting investigations are now going forward pertaining to the generating of electricity directly from daylight. It is stated that this is feasible, but results promising of commercial application have not yet been obtained.

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

Commenting upon the editorial "The Manufacture of Side Lines," on page 18 in September MACHINERY, the writer endorses the views there stated. Just to take some standard machine, redesign it, and merely swell the list of competitors in that field is a gesture that may promise well when described enthusiastically to the board of directors, but seldom works out in practice.

It is better for a company to stick to its regular line, and to concentrate on engineering improvements and cheaper production methods. Instead of engaging in a side line, it is generally safer to merely bid on contracts for special machinery to be built to the customer's own design.

To adopt as a side line a product in which others may seem to enjoy good business is merely to launch a competitive war, with the same result as in all other wars—all the participants lose.

During the present business depression many attempts have been made to engage in "side lines," but few have met with real success.

HARRY KAUFMAN

Bonus System that Prevents Defective Work from Reaching Customers

A medium-sized manufacturing plant has been enabled to produce consistently a high quality article by employing a bonus system that practically makes each employe responsible for the thorough inspection of his own work. This plant produces a widely used small tool which passes through a number of processes, such as rolling, milling, punching and heat-treating. The management believes that one tool returned by a customer as defective results in a greater loss financially and otherwise than would the scrapping of several tools in the factory, even though the scrapping were done after the final operation.

While the management of this concern does not believe in a policy of periodical wage increases, it realizes that long service is worthy of reward. Accordingly, it sets a fixed wage rate which is slightly higher than the average rate ordinarily paid for similar work, and in addition to this, gives each employe a yearly bonus which increases with each year of service. This bonus, however, is not definitely assured unless the worker produces consistently perfect work.

Although defective work is rejected during the various processes in the factory and the parts receive a final inspection before shipment, the management believes that the final inspection cannot entirely eliminate the possibility of an imperfect part reaching the customer unless each part is practically perfect when it reaches the inspection department. Therefore, for each defective tool that is returned by a customer, a specified sum is deducted from the bonus of the employe upon whom the responsibility for the defects may be definitely placed. The penalty imposed may be several times the value of the finished tool, so that the loss to the worker will be sufficiently great to insure watchfulness.

Needless to state, very few tools are returned by customers, because each employe, in addition to acting as his own inspector, instinctively watches for defects in previous operations, knowing that a fellow-worker may be placed in a position to lose bonus money if a defective part is allowed to pass. Incidentally, the work of inspection, instead of becoming a mere matter of form, develops proficiency, as the defective pieces are so few that the inspector is constantly on the alert to detect them.

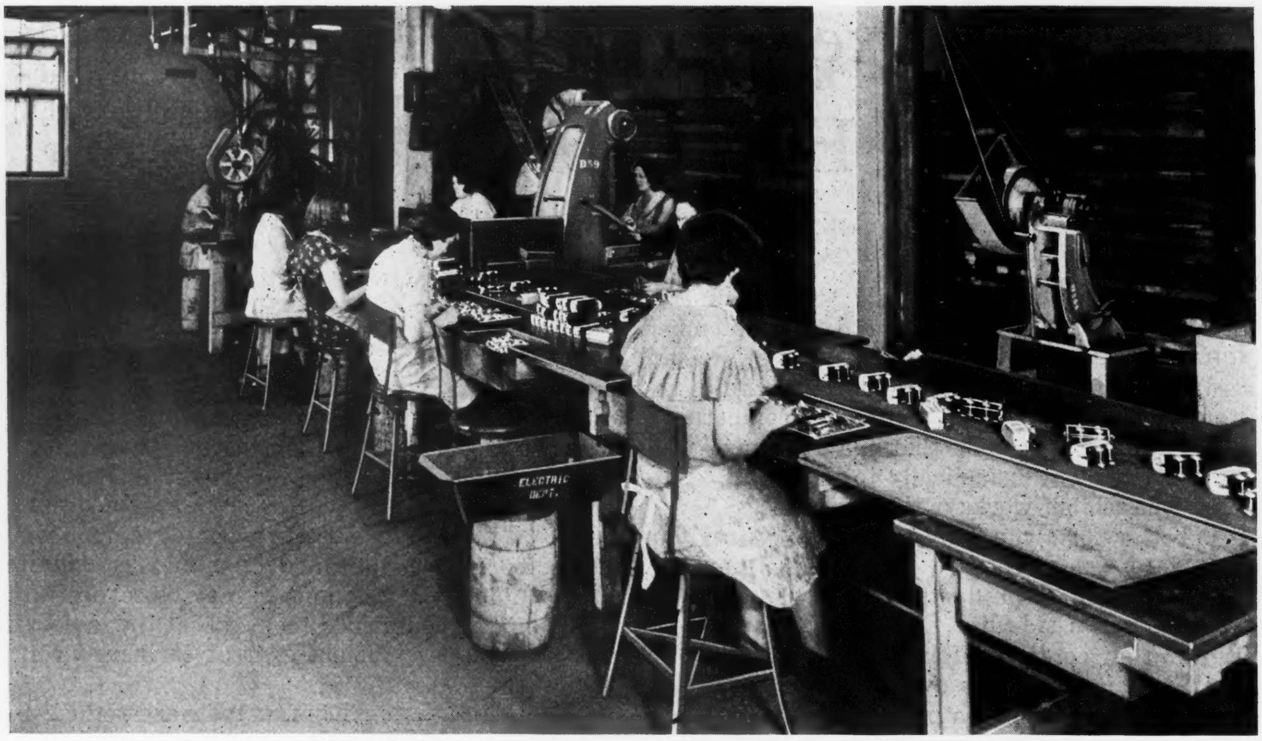
R. H. KASPER

Giving a Man a Chance to Look Ahead

Referring to the article on page 182 of November MACHINERY "Give a Man a Chance to Look Ahead," I have an idea that when men with steady jobs at the present time apply for other positions, they are, in the majority of cases, of the type to whom grass always looks greener on the other side of the fence. If not, they belong to the class that shop around, hoping for a windfall. In other words, I do not believe we should take them too seriously.

In my opinion, an employer should not promise advancement at the time of employment unless it can be definitely foreseen. If an employer follows a logical system of filling vacancies from within the organization, it is not necessary to promise—the new employe soon finds it out. If the employer has the confidence of his men, I believe that he will duplicate my own experience and have his men come to him openly for advice when there is a new job offered. Then he can honestly outline what the chances for promotion are, provided that he is convinced that the employe is likewise honest with him and is not merely trying to "hold him up." When employer and employe can get together in this way, the problem is greatly simplified.

CHARLES KLYNE



Assembling 14,000 Railway Cars a Day

FIVE girl assemblers and two girl press operators turn out 14,000 railway cars a day in the plant of the American Flyer Mfg. Co., Chicago, Ill. This is *not* a typographical error. These girls are working for Santa Claus, and these railway cars are destined to delight the hearts of small boys (and bigger ones, too) on Christmas morning.

The car bodies come in lithographed sheets of tin, large enough to make twelve cars from. These sheets are sheared into four pieces. The smaller sheets are then fed through a press which blanks out three cars from each sheet. Openings for the windows are blanked out at the same time.

The lithographed blanks are next delivered to the press seen in the heading illustration on the far side of the assembling conveyor. Here the car bodies are partially formed by bending up the two ends of the lithographed sheets. Then the two sides of each car body are bent up in another press. Next, a girl, using a hand-operated fixture, inserts two small prongs into two slits and bends the prongs into place to hold the car body together. The next girl bends up the couplers at each end of the car by hand. The three remaining girls assemble the wheels and axles, the last girl also packing the cars in crates ready for shipment. The flat fabric conveyor belt which carries the cars to the different girls has enabled the high production of more than 1500 cars per hour to be obtained. Although the cars illustrated are for "wind-up" trains, cars for electrical trains are assembled in the same line.

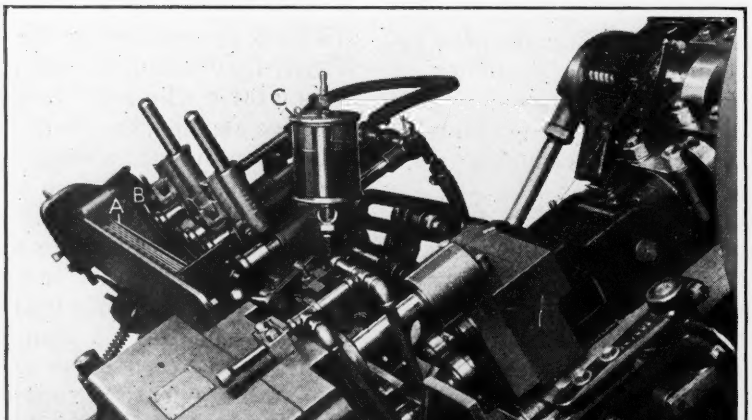


Fig. 1. Machine that Blanks out Car Wheels at the Rate of 225,000 per Day

Gilding the Car Windows

Modern methods are used throughout this work-shop of childhood's pa-

tron saint. Fig. 2 shows a girl gilding the window "frames" of railway cars with a spray gun. She holds a sheet-metal mask against the sides of the car in which there are openings that expose the car windows to a spray of bronze paint. A similar curved mask is used on the ends of the car. The use of this spray gun has increased production 75 per cent over the previous method of painting the windows by hand.

Making Cross-Over Track Sections

Eleven separate pieces that make up the cross-over tracks, such as seen on the table in Fig. 3, are

Fig. 2. Painting the "Frames" of Car Windows by the Use of a Spray Gun

simultaneously assembled at one stroke of the press. This operation has been made 100 per cent safe by requiring that the loading and unloading be done with the die swung forward from under the press ram, as illustrated. When the die is in this position, the ram cannot be tripped, and even when the die is in the operative position, both the handles on the opposite sides of the machine must be held down by the operator to trip the press.

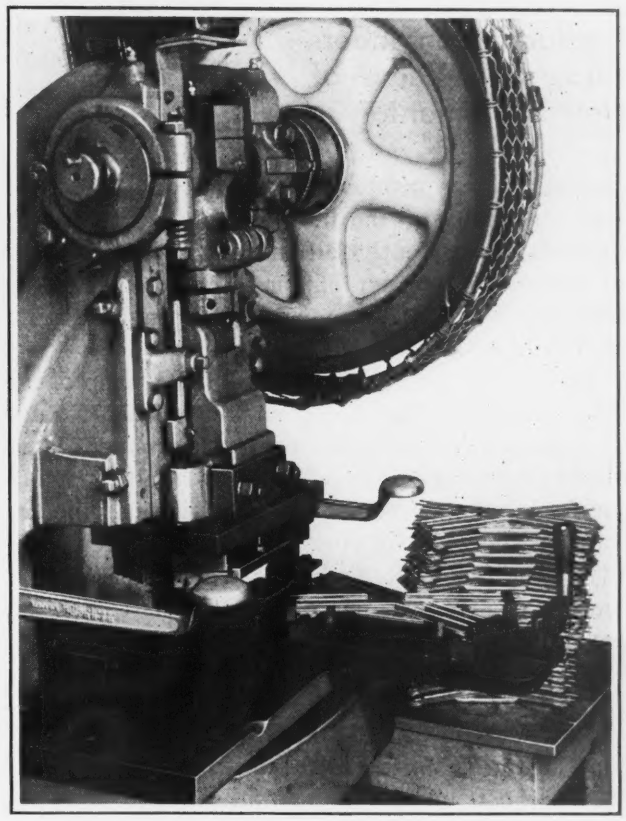
The punch has fifty-four fingers which bend sheet-metal prongs to tie the different tracks to the base members. These fingers are beveled at the working ends so as to bend the prongs gradually and then give a final clamping action. It will be seen that the tracks are located properly by means of slots in blocks at the ends of the die.

A Machine that Produces 225,000 Car Wheels a Day

Wheels for the cars and locomotives are blanked at the rate of 225,000 per nine-hour day in the high-speed automatic punch press illustrated in Fig. 1. Three disks are blanked at a time from tin plate 0.015 inch thick, the three punches being staggered to save scrap. The strips of stock are placed in a magazine *A* from which they are lifted, one at a time, by four suction pads *B* which are connected to a vacuum pump on the machine. These suction pads move back and forth in bearings to lift the sheets consecutively into line with V-blocks leading to the dies. Two sliding members push the strip into the V-blocks.

The strips are fed intermittently until an entire strip has been blanked, after which the scrap stock

Fig. 3. Cross-over Tracks are Assembled on a Fool-proof Punch Press



is automatically thrown clear of the machine. As each strip is fed to the dies, the upper side is lubricated by coming in contact with rollers that receive oil from the large cup *C*. The blanks produced in this machine are later formed into wheels by other punch presses.

Production methods of the most highly specialized type have replaced the old toy-makers' primitive equipment. Even Santa Claus has become mechanized; but there is no risk of technological unemployment as far as his job is concerned.

EDITORIAL COMMENT

Production Engineers Know the Value of New Equipment

At a recent meeting of the production men in the automotive industry, several engineers voiced the opinion that much of the shop equipment in the industry is obsolete and that there is urgent need for new and better equipment. Unfortunately, the men controlling the finances of the automobile plants do not fully recognize the fact that the best possible shop equipment must be provided if the production engineer is to be able to meet the constant demands for reduced costs.

How to reach the ear of the man who controls the purse strings, and how to demonstrate to him the need for the replacement of equipment no longer suitable in automobile manufacture, is one of the production engineer's most serious problems. Some automobile plants have a definite procedure for showing in black and white the advantages of the replacement of old equipment and the installation of new; but in many plants reliance is placed mainly on the persuasive arguments of the production engineer. Unfortunately for the industry, his arguments, in these days, frequently fall on deaf ears. It is easier to measure the cash balance of today than the accruing profits of tomorrow resulting from improved equipment.

The financial man not familiar with shop operations cannot see why money should be spent for new equipment at a time when present equipment is not used to capacity. It is difficult for him to visualize the fact that the time to make changes of this kind is when the plant is operating at a reduced capacity. The fact that Andrew Carnegie was able to see this clearly, was one of the reasons for his unparalleled success in the steel business.

Single-Bid Rule Essential to Good Business

The business practice known as "firm bidding," that is, the submitting of bids that are final and that are not subject to modifications to meet the proposals made by other bidders, is receiving more and more attention in industry. The method is also known as the "single-bid rule." It is the only ethical method for making bids—the only procedure that is thoroughly satisfactory to both buyer and seller and perfectly "square" to both competitors and customers.

At a recent meeting of the Steel Founders' Society in Chicago, Arthur Simonson of the Falk Corporation, Milwaukee, Wis., presented a paper on this subject, in which he emphasized the importance of this principle of business practice. It is gratifying to be able to record that some trade organizations have already taken definite action with regard to firm bidding. The Machinery Builders' Society, as far back as 1928, adopted a resolution on this subject to the effect that one bid only would be submitted, and that this bid would remain unchanged unless an alteration in the purchaser's specifications warranted a new quotation.

Our entire business structure will rest on a firmer foundation when industry as a whole adheres to the principle of "firm bidding." Trade associations would do well to adopt it as a fundamental rule for their members.

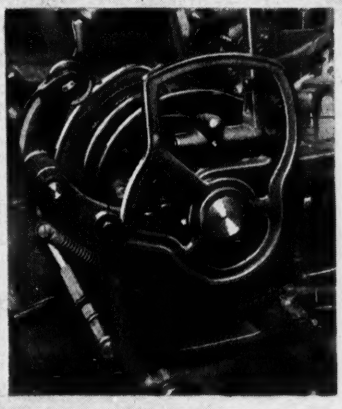
An Accepted Standard Should be an Applied Standard

We recently came across the quotation "It isn't enough to convince a man that you are right; you must get him to act on his conviction."

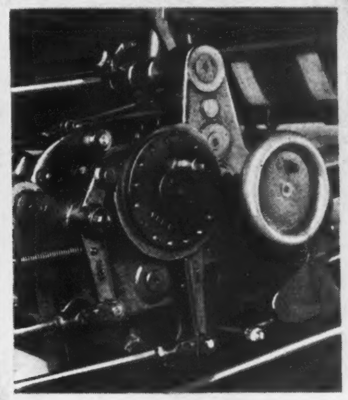
This quotation applies to much of the work done by engineering and trade associations. Conventions are held, able speakers advocate commendable lines of action, and the members applaud the speakers, and are thoroughly convinced that they are right. It is generally agreed that it would be valuable both to individual companies and to industry as a whole to follow the suggestions made. Yet, beyond the applause, no definite action follows.

Somewhat similar conditions may be observed with reference to standardization work. Engineers labor hard to develop standards acceptable to industry. The standards are approved by the final authority in each case, whether it be the board of an association, a society as a whole, or the American Standards Association, which has the final say in national standardization projects. But, after the standard has been approved, very little is done to promote its application in industry at large. The standardization committee has finished its work; and whether or not the standard is generally accepted depends largely upon the action of individual engineers throughout industry.

Perhaps the most important work in connection with standardization is not the formal acceptance of a standard by an association, but the work that follows the acceptance—that is, the steps taken to induce industry to make use of the standard.



Ingenious Mechanical Movements



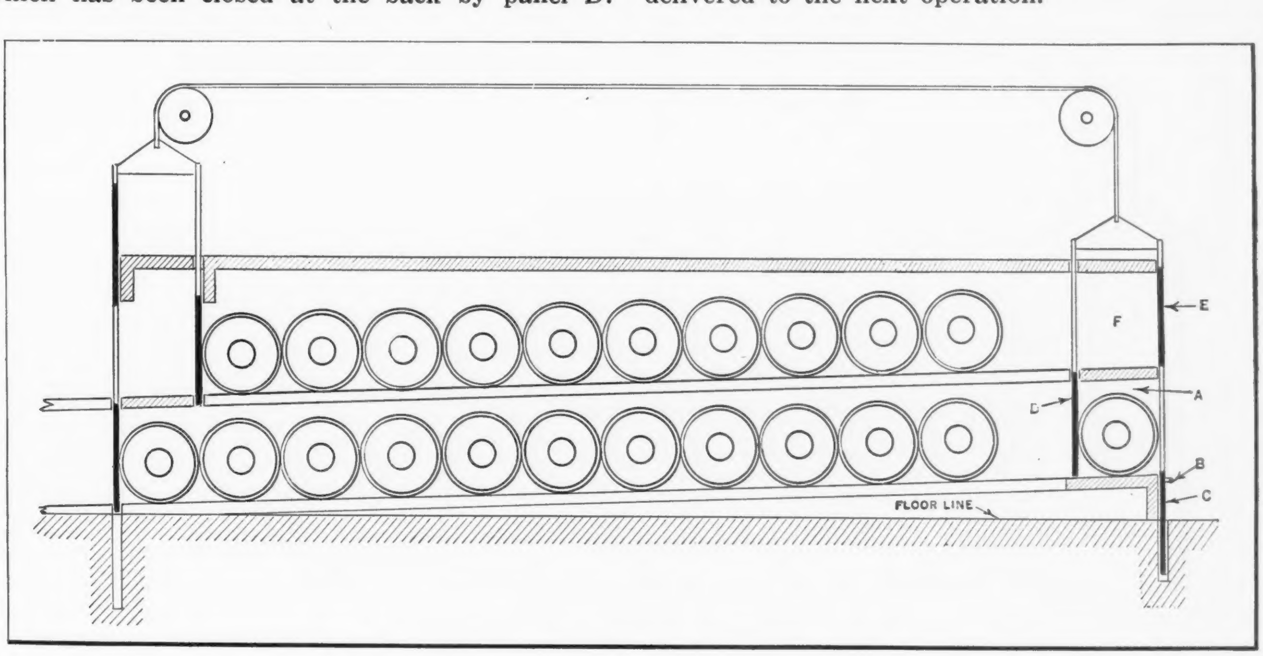
Door Control for Enameling Oven

By ALBERT O. ROBERTS

An oven for baking the enamel on automobile wheels is so arranged that the wheels roll down gravity runways through the oven and are automatically discharged into runways which lead them either to the next operation or to the loading dock for shipment. The baking time for a given length of oven depends entirely on the rate at which the wheels are put in.

In operation, the wheels are placed twelve abreast in compartment *A* (see vertical longitudinal section). The operator, using handle *B*, then raises the door, which is made of three panels—*C*, *D* and *E*—all mounted rigidly on a common frame and suspended from above. As the door is raised, panel *C* rises closing compartment *A*, and panel *D* rises, letting the twelve wheels roll into the oven. Simultaneously panel *E* rises, opening compartment *F*, which has been closed at the back by panel *D*. Compartment *F* is now ready to be loaded with twelve wheels, after which the door is lowered again to reload compartment *A*.

The door at the discharge end is similarly constructed, and provides an automatic escapement for the wheels. The doors are connected by two cables which pass over sheaves above the oven and thus counterbalance each other. The two sheaves at each end are keyed to the shafts in order to keep the doors on an even keel and make them work freely in their guides. The two doors being connected, the discharge door is automatically lowered when the charging door is raised and vice versa, thus releasing a row of wheels every time a row is put in and keeping the oven full all the time. The man at the loading end sprays the wheels and places them in the runways, closing the door when he has inserted twelve wheels. Then, without further labor or attention on the part of the operator, they are baked the proper length of time and delivered to the next operation.



Vertical Longitudinal Section of Enameling Oven

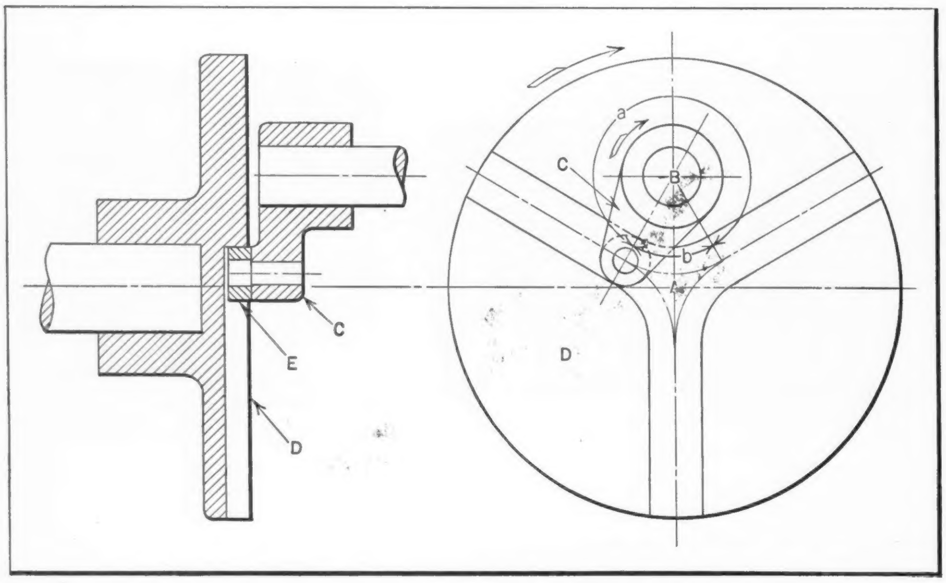


Fig. 1. Three-station Inverse Geneva Wheel Mechanism

With a given number of wheels per hour to be baked, any desired length of baking time may be obtained by making the oven of the proper length. Another point to be noted is that the doors are closed practically all the time, which cuts down the loss of heat to a minimum and also adds greatly to the comfort of the operator.

* * *

Inverse Geneva Wheel Motion

By WARREN P. WILLETT, Assistant Designing Engineer
National Automatic Tool Co., Richmond, Ind.

The term "inverse" is applied to an unusual and relatively new form of the well-known Geneva mechanism for producing intermittent circular motion, because the driving and driven members rotate in the same direction, whereas with the usual form of Geneva motion, the rotations are reversed. The arrangement is such that the driving crank axis and the crank circle are entirely within the radius of the plate or driven member, and this produces a vastly different effect in the timing, acceleration, and the velocity of the plate. These effects are things to be considered in applying the mechanism to a machine design. In some designs, the effects produced may not be altogether desirable, while in others they may have distinct advantages and introduce an improvement.

The inverse Geneva stop or wheel motion is the invention of J. R. Schultz of the E. W. Bliss Co., Brooklyn, N. Y. It was developed about fifteen years ago to fill the requirements of a particular type of drive for feeding strip stock into power press dies. Since its inception a variety of successful applications in automatic machinery have been made, but it is not widely known to designers and up to the present time, little or nothing has been published regarding its action and peculiarities.

Some typical forms of the inverse Geneva wheel are shown in Figs. 1 and 2, the former showing a three-station and the latter an eight-station plate. The essential parts are few and simple, consisting of a constant-velocity driving crank *C* and a variable-velocity driven member *D*, called the plate. The plate rotates in equal intermittent movements from station to station, stopping for a short interval of time at each station. As the rotation of the plate is caused by the motion of the crank-pin roller *E* in passing through radial grooves in the plate surface, the number of stations is dependent upon the number of grooves.

The smallest number of radial grooves with which a Geneva mechanism will function is three. The greatest number is infinite, being limited only by the diameter of the plate and the width of the grooves, both of which may theoretically be made to any proportions. In actual practice, however, the number of grooves required is not very great.

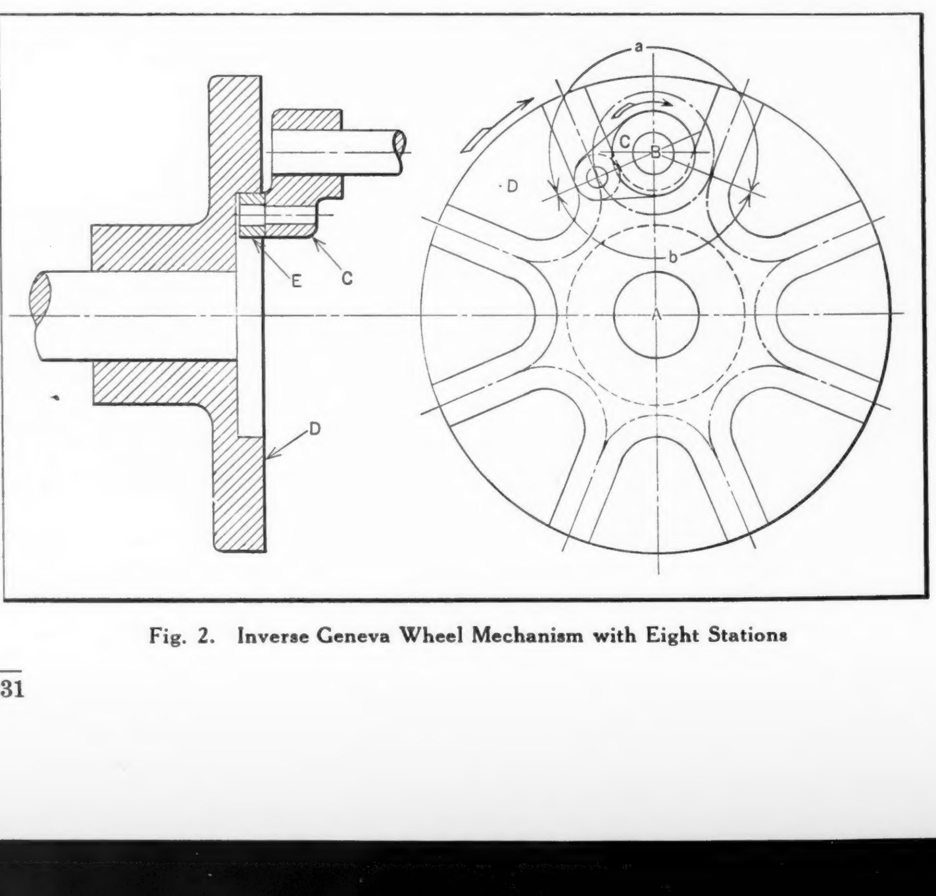


Fig. 2. Inverse Geneva Wheel Mechanism with Eight Stations

By comparing Figs. 1 and 2 it will be seen that as the number of grooves increases, the working angle a of the driving crank decreases and the idling angle b increases. These angles are determined as follows: Referring to Fig. 3, the angle s between two adjacent radiants on the Geneva plate is equal to 360 degrees divided by the number of radiants N. As the roller enters and leaves the grooves when the crank center line is at right angles to the radiants, two equal triangles are formed by the lines AEB and $AE'B$, from which it is seen that angle b equals $180 - s$. Then angle a equals $360 - (180 - s) = 180 + s$.

Fig. 3 also shows some of the practical points to be considered in the design of an inverse Geneva wheel or stop. In both Figs. 1 and 2 the inner ends of adjacent grooves are joined by a circular arc which is concentric with the crank circle. This arc is of little or no use, and to facilitate machining, it is preferable to connect the grooves with straight lines, as at h, Fig. 3. The corners should be broken by a small radius to permit the roller to enter the grooves more easily.

In any sort of intermittent motion device it is desirable, and usually necessary, that some means be provided for locking the driven member in position while it is at rest. The locking feature employed in this mechanism is shown in Fig. 3. In this illustration, a circular arc lobe, machined concentric with the driving crank axis, is shown as an integral part of the crank at d.

During the idling period of the driving crank, this lobe is in contact with one of the locking segments e, which are made to project from the face of the plate and are machined to the radius of the lobe just described. This feature prevents any accidental rotation of the plate while it is in one of the rest positions. The angles f and g subtended by the arcs on e and d, respectively, are equal, and their magnitude is a matter that should be given careful consideration.

The angles should be made as large as possible in order to keep the plate locked during the entire time that it is not in motion, but making them too large will result in interference of the parts. The best results are obtained by making angles f and g each equal to angle b. This permits the locking action to begin the instant the crank roller leaves one groove and to end the instant it enters the next groove. This, it will be seen, is the case in Fig. 3. The heavy full outlines show the crank in the act of entering a groove, while the left half of the locking segment is just being cleared by the lobe on the crank so that rotation may begin in the plate. The light dot-and-dash outlines show the crank in the act of leaving the groove, with the lobe engaging the left half of the locking segment.

A locking segment e is placed midway between each two grooves, as shown. Their centers represent the relative positions of the crank during the idling interval between working periods. The radius of the locking segment is more or less arbitrary, but it will be limited by the radius of the plate. The locking segments do not add greatly to the cost of manufacturing the plate, because their shape is quite simple. In fact, the structural lines of the entire plate are made up of simple geometrical figures and are easily machined without the use of templets or masters.

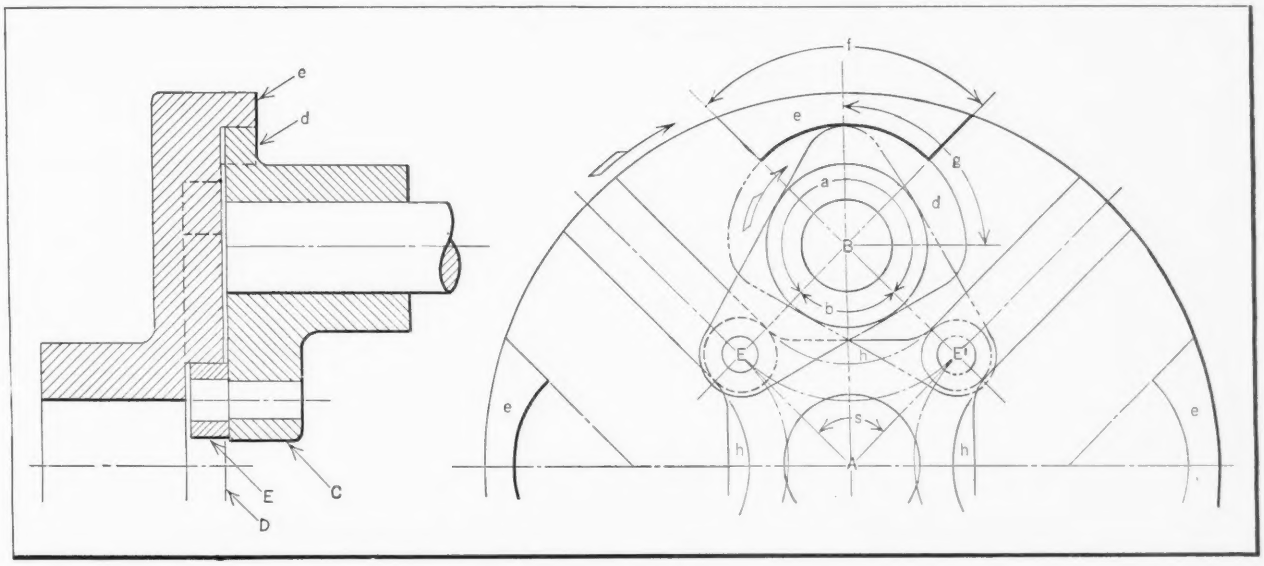


Fig. 3. Locking Arrangement Employed on Inverse Geneva Wheel Mechanism

* * *

Figures recently published by *Lloyd's Register* show the present trend in the design of marine engines. The total horsepower of engines either under construction or being installed on board vessels not yet launched, on September 30, was 1,704,000. Of this, 108,000 horsepower represented reciprocating steam engines; 978,000 horsepower, steam turbines; and 618,000, oil engines. Measured by horsepower output, Great Britain and Ireland occupied first place; Italy, second; United States, third; France, fourth; and Germany, fifth.

New Designs Visualized by Shade Drawings

Properly Made Shade Drawings Serve the Purpose of a Photograph and Aid Greatly in Explaining Mechanical Features

By M. A. HOLLENGREEN, Assistant Chief Engineer, Landis Machine Co., Inc., Waynesboro, Pa.

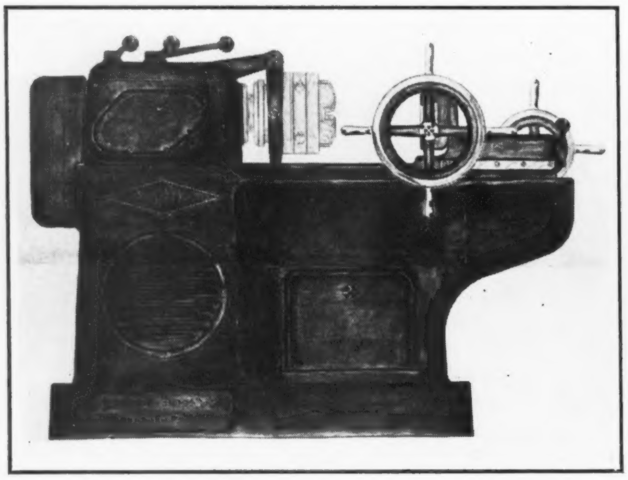


Fig. 1. Example of Shading on an Assembly Drawing, which is Done to Present a Clearer Picture of the Machine, and Gives the Effect of a Photograph

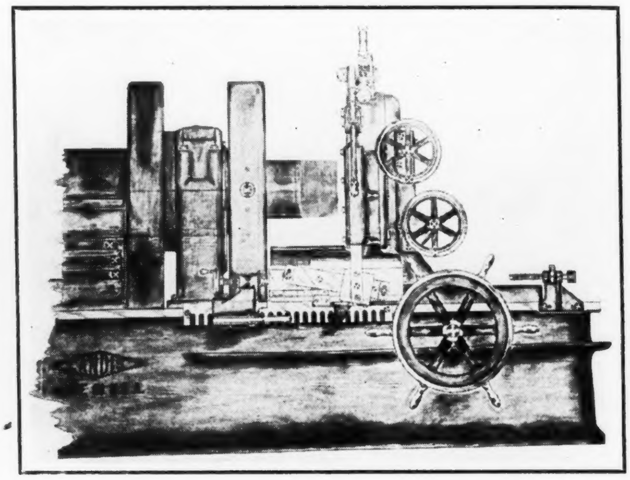


Fig. 2. The First Stage in the Shading is Pencil Shading, after which Powdered Graphite Blended in by a Gum Eraser Adds the Required Finish

THE sales organization affords the designer one of his most valuable sources of information. Because of his intimate contact with the purchaser, the salesman is in an ideal position to know the purchaser's needs and requirements. However, the designer must find a suitable means of presenting a clear picture of the proposed design to the salesman. Detail and assembly drawings ordinarily cannot be used for this purpose because of the difficulty in visualizing the finished machine.

Three methods sometimes employed for conveying the desired picture of a machine are: Clay models, full-size outlines of the front and side elevations cut from wood, and full-size wooden models. Clay models, however, can seldom be made full size, their construction requires a great amount of time and skill, and much of the detail is often lost. Outlines cut from wood are still less useful, because they deprive the spectator of all sense of perspective; and in this case, also, the detail is difficult to show. Full-size wooden models are good, but they require a great deal of time and are expensive.

In Figs. 1, 2, and 3 is shown a method used successfully by the Landis Machine Co. of Waynesboro, Pa. Regular full-size assembly drawings of the machine are made, showing the outline of each detail but omitting all dotted or hidden lines. The prominent contours are then shaded. The only equipment necessary to make the drawings consists of a soft lead pencil having a lead about 5/32 inch in diameter, an art gum eraser, an erasing shield, and a small quantity of powdered graphite such as is used to dust molds in the foundry.

The drawing of a pipe threading and cutting-off machine in Fig. 2 shows clearly the pencil shading. After this shading has been done, the pencil lines are blended together by means of the gum eraser, stroking from the dark toward the lighter sections in order to produce a smooth appearance. Powdered graphite is then dusted on the drawing with a pad made of cheese-cloth. Parts made of finished steel, however, are not dusted, and where a deeper tone effect is required, the graphite is applied more generously and blended in with the gum eraser. The effect of using the graphite will be evident

Fig. 3. End View of Machine Shown in Fig. 1. Note how Shading Brings out the Important Details

by glancing at Figs. 1 and 2. When it is essential to have certain contours stand out from the rest, a thin white line is erased along the contour. An ordinary eraser and erasing shield are used for this purpose. The shading is also erased where high lights are necessary.

This method has proved an inexpensive and very effective means of portraying the desired picture, and affords a common ground for discussion between the designer and the salesman. Its advantages are many. It requires comparatively little time and skill to make the drawing. No attention need be paid to the source of light; nevertheless, it will be noted that each detail is clearly portrayed. The pictures also show depth and a fair amount of perspective. Another important advantage is the fact that the pictures can be made by the designer himself during the preliminary stages of the lay-out, at which time changes can be readily made to incorporate any new ideas suggested.

Making Castings in Permanent Molds*

A Successful Method of Making Gray Iron Castings by a New and Radically Different Process

By J. L. DOSTAL, Manager
Holley Permanent Mold Machine, Inc.
Detroit, Mich.

DIFFERENT alloys have been tried out for making permanent molds, but it has been found that the most economical method is to produce them from regular cast iron; in other words, the mold is made from the same iron that is used for the castings.

The procedure is as follows: First, a lay-out or drawing is made of the mold, showing the gating and the position of the casting in the mold. After this, a hard-wood or metal-faced master pattern is made. The master pattern is made fairly accurate to size, so that it is unnecessary to do any machine work on the impressions in the mold after it has been cast from the pattern. Necessary shrinkage is allowed for, and ordinarily only the front and back of the mold are machine-finished to provide a clean parting line. The pattern is then sent to the core department and a dry sand core is made very carefully. The core that forms the mold face is carefully blackened with graphite so that a very smooth casting is produced.

After the mold is cast, it is allowed to cool over night before being shaken out of the sand. It is then put into a furnace and normalized at 1200 degrees F. to relieve all strains. The mold is then ready to have the face and back machined, and is provided with guide pins to insure proper matching at the parting line.

When returned from the machine shop, the mold is again heated to 300 degrees F. and faced with a refractory facing which is used in liquid form and which, when applied to the heated mold, dries very rapidly, producing a hard baked surface which is very durable and resistant to heat.

Preparing the Mold Surface for the Casting Process

The mold is now ready to be set in the casting machine. Before any metal is poured into it, the entire face is thoroughly covered with a coating of acetylene smoke which acts as a secondary protective coating for the primary refractory coating. This smoking operation is applied automatically before every pouring operation. Every time a casting is ejected from the mold, a little of the loose carbon is removed with the casting, but the refractory coating is left intact.

For ordinary castings, a twelve-head machine is used; and if there are no cores, one man pours continuously while another man ejects the castings. On cored castings, an additional man must be used for setting the cores. The latter are practically of the same type as those used in an ordinary sand foundry.

Twelve-head semi-automatic machines are used for quantity production. When only a few castings per day are required, single-head machines are employed. Special machines are also used for very large castings.

The permanent molding process is comparatively simple, once it is understood. It is necessary for the permanent mold casting plant to train its own operators, because there is no supply of trained men available, as in the case of ordinary sand-foundry molders.

Advantages Claimed for the New Casting Process

The following advantages are claimed for the permanent-mold casting process:

1. The castings are uniform in size, thus simplifying inspection and jigging operations.

2. They are of uniform hardness, insuring maximum cutting speeds in machining. It is not necessary to change the speed of the machine to accommodate hard runs of castings, so frequently encountered when the castings are made in sand.

3. There is a considerable saving in the machining operations due to less frequent grinding of tools, cutters, and drills. The fact that permanent-mold castings are free from sand-scale makes them less likely to dull the cutting edges of tools.

4. The space required to produce the same quantity of castings by the permanent-mold method as in the ordinary sand foundry is only from one-eighth to one-tenth as great. In other words, per-

*Abstract of a paper read at the Production Meeting of the Society of Automotive Engineers, Detroit, Mich., October 8.

manent-mold casting machines will produce from eight to ten times as many castings with a given floor space as can be produced in the ordinary sand foundry.

5. The automatic features of the machine set the pace for the men, resulting in low cost.

6. The permanent-mold method gives cleaner and more healthy conditions for the men operating the machines.

7. It is possible to obtain castings for inspection immediately after the casting is made; hence defects are detected at once, instead of having to wait hours and sometimes a whole day before the castings are shaken out of the sand. The structure of the castings is close-grained, and they are free from shrinkage strains and cracks, even in the very heavy sections.

8. There is an increase in the tensile, transverse, compression, and impact strength of the castings due to their uniformly close grain. This makes the casting suitable for high-pressure requirements.

It is possible to control the casting and annealing operations so that practically any commercial degree of hardness is obtainable. At the present time there are in use, experimentally, molds with an improved facing which promises to more than double their life. This development will open up a vast field formerly closed to the permanent-mold machine, because of the cost of upkeep of the molds when castings having heavy sections were to be made.

Effects of Machine Gas-Cutting on the Metal Cut

At the annual convention of the International Acetylene Association held at the Congress Hotel, Chicago, Ill., November 13, L. M. Curtiss, superintendent of the 140-inch and 206-inch rolling mills of the Lukens Steel Co., Coatesville, Pa., read a paper entitled "Some Methods and Effects of Machine Gas-Cutting." This paper dealt with the methods of gas-cutting heavy plate and the metallurgical effect upon the metal cut. It further dealt with the question of economy of gas-cutting. Methods of paying labor for cutting plate by the gas method were also discussed. The plan that has been developed by the Lukens Steel Co. in this connection is of considerable interest.

At first, an incentive wage payment plan for the cutting of heavy plate was considered unsuitable, as large plate can easily be spoiled by hurried work. Furthermore, the cost of the oxygen and acetylene consumed in cutting heavy thicknesses is several times the cost of the labor involved. With such a system, there was the danger that an operator, in order to do this task in the least possible time, would use an excessive amount of oxygen, thus more than counteracting any savings derived from fast work.

After much study, a payment plan was devised whereby each man is paid for the exact amount of work done and, in addition, is paid a bonus on the amount of oxygen saved beyond a set standard. A penalty is also exacted for poor workmanship. The plan has proved successful. The oxygen consumption has taken a downward course, resulting in great savings. The amount of rejected material due to carelessness has been greatly reduced.

The effect of gas-cutting on the material being cut was covered in great detail, with photomicrographs showing the effects of cutting. The precaution of preheating the steel before gas-cutting was recommended. Hot-cutting not only tends to preserve the quality of the steel, but is also economical in the use of oxygen.

A Problem that Puzzles Designers

Few problems met with in machine design present as many difficulties to the ordinary designer as those that involve planetary gearing. In January MACHINERY, F. D. Furman, Professor of Mechanisms and Machine Design at Stevens Institute of Technology, will solve another difficult problem in planetary gearing—in this case, a construction involving two driving members running at different speeds. The solution of this problem has not been previously recorded in print; textbooks and other engineering literature have, so far, had nothing to give the designer that would help to develop a mechanism involving these conditions. Designers will, therefore, welcome this article as a distinct contribution to engineering literature.

* * *

After a decided drop in the exports of industrial machinery, September—the last month for which complete statistics are available—indicated a renewed upward tendency. The total exports of industrial machinery from the United States in that month exceeded $13,000,000, which, while falling below the figure for September, 1930, was considerably above the exports for July and August this year. During the first nine months of the present year there has been continued activity in sales of metal-working equipment abroad. According to the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, the exports of metal-working machinery during this period exceeded the exports during the corresponding period in 1930 by more than $1,000,000; the exports in September, 1931, amounted to $5,348,000, as compared with $3,239,000 in August this year, and $2.367,000 in September a year ago. Sheet and plate machinery, forging machinery, gear-cutting machines, and drilling machines show the greatest increase.

A Test for the New Carbide Cutting Tools

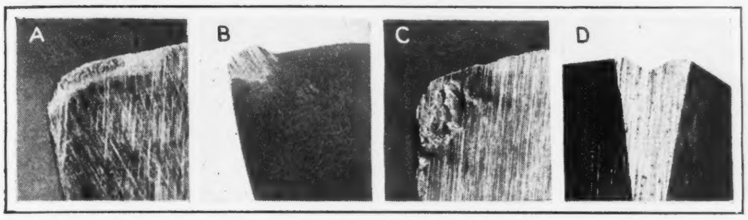


Fig. 1. A Shows the Formation of a Pinnacle Back of the Cutting Edge; Cross-section at B, the Height of the Pinnacle; C, the Crater Formed after the Pinnacle is Broken off; and Cross-section at D, Depth of Crater

Whether or not the Carbide Cutting Materials are Satisfactory for Machining a Given Metal can be Determined by a Simple Test

By A. W. SWANSON
Illinois Tool Works, Chicago, Ill.

TUNGSTEN-CARBIDE, tantalum-carbide, and other hard cutting metals are being used successfully in many metal-working plants—both large and small. In some plants these hard metals have been tried and pronounced failures, but there are many plants where they have never been tried. Some of the executives in the latter plants are under the impression that the carbide tools are too expensive to use. In answer to this objection, it may be pointed out that increased production in the plants where these carbide cutting materials are being employed, fully justifies their use.

Successful use of the tools necessarily implies either better work or lower costs or both. Better work is obviously something that cannot easily be defined, but it is reasonable to assume that a material that will hold its keen cutting edge over a longer period of time will do better work.

As to costs, the life of a tool and its initial cost are small items compared with the machine-hour rate cost of using the tool. Production increases ranging up to 1000 per cent are not uncommon. Where applications are practicable, the returns fully justify the extra tool cost.

Tests to Determine Applicability of the New Cutting Tools

To determine the practicability of these carbide-tipped tools is neither difficult nor expensive. We start with the assumption that there is no universal cutting material—that is, the various cutting metals have their own field where they perform to best advantage.

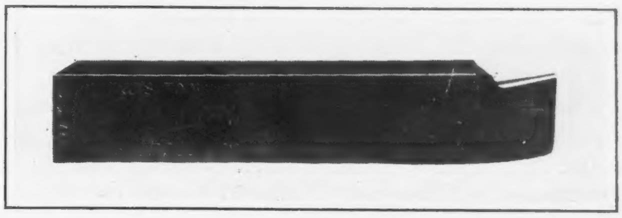
To determine whether a certain type of carbide-tipped tool is adapted for cutting a given material, we run what we term a "cratering" test. This test is made on a lathe with approximately 3/32 inch depth of cut, a feed of 0.020 to 0.030 inch, and a moderate speed. The speed depends on the type of material cut, but is not important, as the results will be similar whether the speed is fast or slow. Speed cuts down the time required for the test.

The lathe should be stopped every few minutes to observe the cutting edge of the tool. If the face of the tool remains smooth, the test should be continued for ten minutes with stops at two-minute intervals to observe the condition of the tool. Any time that a roughened surface appears on the face, the tool should be taken out. If examined under a magnifying glass, this roughened surface will show as a crater, with well defined breaks around its edge. It has no appearance similar to wear. (See Fig. 1.) The term "cratering" may not be the correct term to characterize what takes place, but the appearance of the roughened tool differs from the appearance of a tool that has been worn, and so the word "cratering" is used to indicate this condition for lack of a better term. After all, the main thing is that the meaning of the term be clearly understood by those using it.

A discussion of the reasons for the formation of the crater is immaterial in this case, and the writer is not prepared to say what the cause may be. Whether it is "affinity," "coefficient of friction," or something else would be of interest to know, but for the practical purpose of determining tool application, we can overlook the cause and direct our efforts to the effect.

The cratering action starts with fine particles adhering to the face of the tool directly back of the cutting edge. There appears to be a fusion. These fine particles build up a sort of pinnacle which

Fig. 2. It is Wasteful to Make the Carbide Cutting Tips Too Long



breaks off after reaching a certain height. (See Fig. 1, *A* and *B*.) In breaking, a part of the surface of the tool is removed, leaving a rough surface or crater. (See *C* and *D*.) Continued running causes further building up of pinnacles which break and make deeper craters, until in time, the crater weakens the edge of the tool and it breaks off.

These short tests will determine whether a hard metal-cutting tool can be used for cutting a particular material. Tests conducted over a considerable period of time have proved that, when cratering develops, the tool eventually fails, and the tool should be discarded for use on material of that particular analysis. Cratering tests with simple lathe tools will save losses in ruining more complicated and costly tools. No tools are ruined when a lathe tool is used, as the craters can be ground out. When cratering develops, tests show that changing the tool size, angles, rakes, and cutting compounds will not make the tool perform nor stop cratering.

Tests made with Ramet-tipped tools ranging from 84 to 92 Rockwell hardness showed no difference in the cratering action. Slight changes in the tool ingredients did make a difference. The conclusion reached is that the chemical properties in the tool and not the hardness are the controlling factors.

Observations by the writer of many carbide-tipped tool tests have shown more of a desire on the part of users to determine tool life than to determine tool value. Too many tests are run at predetermined feeds and speeds to the detriment of the best tools. As an illustration, a hard tool may be run at a high speed, with a light feed, and show up better on a test for life than a softer tool, but it would fail, due to brittleness, if a heavier feed were used. A softer tool might take a much heavier feed, with a slower speed, and show a much improved production figure. Comparative tests of tools should be run with each tool at the maximum feed and speed that it can stand.

The statement was made that tool ingredients make a difference in the cratering tests. A change in the ingredients of the material being machined also makes a difference. Tools that work on carbon steels or nickel steels may fail on vanadium steels, or may fail on one class of material within a range. All tools should be tested on the actual material they are to cut.

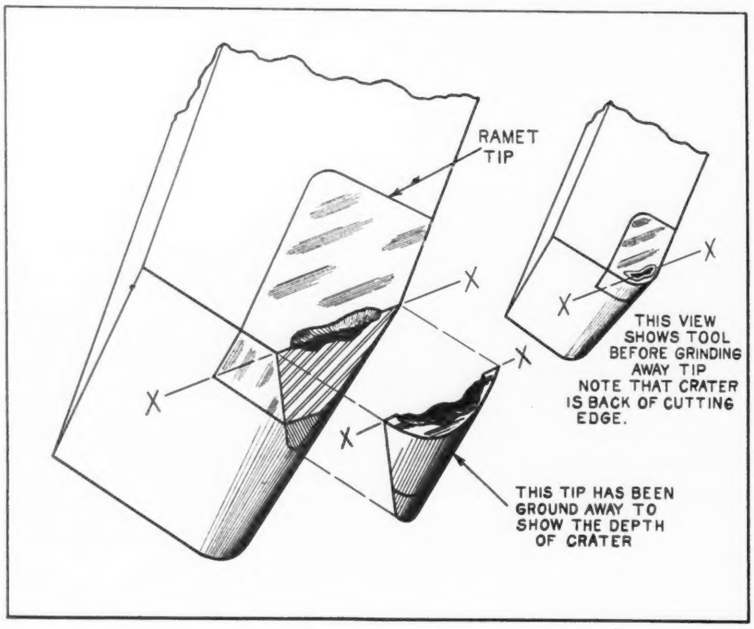


Fig. 3. Drawing Illustrating the Formation of a Crater Back of the Cutting Edge of the Tool

Much of the failure of carbide-tipped tools has been blamed on vibration or chatter in the machine tools. While vibration is the enemy of fast production, and the new rigid machines increase production, the fact remains that a rigid machine will not compensate for an improper tool. Tests show that the machine tool has no effect on the cratering action, but rigid machines prove their worth in the heavier feeds and faster speeds that can be used.

It is interesting to note that when the carbide tip does not crater, the maximum machine tool speeds can be used—in fact, the speed limitations have not yet been reached. On the other hand, when the cut taken is heavy enough so that the chip pressure is equal to the strength of the carbide, it will break.

It should not be assumed from these statements that the tests show that carbide tools are limited to only one type of material, as this is not the case. A single tool has been used successfully on fiber, brass, bronze, cast iron, 15 per cent manganese, nickel steel, nickel-chromium steel, carbon steel, chromium-vanadium steel, and molybdenum steel; but this tool cratered on SAE 4615 steel. This indicates that the tool can be used on all these materials except SAE 4615 steel. Further tests are necessary to ascertain the maximum production that may be obtained. In the following are given the results of a test run to determine maximum production. The speed was increased to the full capacity of the machine.

Turning 9-inch Diameter. Material, SAE 1045 Steel. Heat-treated. Hardness, Brinell, 248 to 286. Depth of Cut, 3/16 Inch

Test No. 1. 59 feet per minute...Feed, 0.015 inch
Test No. 2. 92 feet per minute...Feed, 0.015 inch
Test No. 3. 151 feet per minute...Feed, 0.015 inch
Test No. 4. 419 feet per minute...Feed, 0.015 inch
Test No. 5. 603 feet per minute...Feed, 0.015 inch
Test No. 6. 417 feet per minute...Feed, 0.032 inch
Test No. 7. 603 feet per minute...Feed, 0.032 inch

High-speed steel tools were used at 42 feet per minute, with a feed of 0.010 inch. This test showed the Ramet tools to be forty-five times faster than the tools used in the past.

The figures given below are from a test that was stepped up to machine capacity in four changes. After the application of a tool has been proved by the cratering test, there is little to fear from tool failure, and feeds and speeds can be readily determined.

Turning 7 3/8-inch Diameter. Material, S A E 5135 Steel. Depth of Cut, 5/32 Inch

Test No. 1. 77 feet per minute...Feed, 0.010 inch
Test No. 2. 196 feet per minute...Feed, 0.010 inch
Test No. 3. 406 feet per minute...Feed, 0.020 inch
Test No. 4. 643 feet per minute...Feed, 0.020 inch

Importance of Carbide Tip Sizes

The size of tip to be used in a tool is dependent upon the work to be performed. Obviously, for economy, tip sizes should be kept small. The most common mistake in selecting tip sizes is to make the tips too long and too shallow. Fig. 2 shows a tip that has been partially ground away. It will be noted that practically one-third of the length is unnecessary and only adds to the time required for sharpening. The life of this tool could be materially increased by adding to the tip thickness and cutting down the length. A study of tools in use shows that on most of them, more stock is removed from the top in sharpening than from the end or side. These remarks on tip sizes have a bearing on the successful use of hard cutting metals, as smaller sizes of tips will reduce tooling costs. Tool manufacturers should not be criticized for furnishing over-sized tips, as they have had to learn through experience, and with more experience, tips will eventually be standardized to conform to economical use.

Angles, Rakes, Feeds, and Speeds

Much has been written regarding the necessity for certain rakes and angles and the use of certain feeds and speeds with carbide cutting tools. These cannot be fixed. Broadly speaking, clearance angles and rake are usually made a trifle less than are ordinarily used on high-speed steel, but for best results, they must be made to conform to the requirements of the material to be cut. Front and side clearance should be held to a minimum, but this minimum is dependent on the feed. On the other hand, the top rake is more dependent on the hardness of the material. If the material is soft, it will form an opening at the cutting edge, leaving the side unprotected; in that case, the rake should be increased until the cutting edge shows chipping, and then reduced until this condition is eliminated. In addition to the hardness of the material, the cutting speed affects the tool rake.

Many of the failures of carbide-tipped tools can be attributed to the use of feeds and speeds taken from a book or written to cover general conditions without considering that the machine tool, the material, and the tool angles, all are controlling factors.

It may be said that these remarks in regard to angles and speeds are too general. Why not be specific? With Ramet tools, we have turned materials with a side clearance of from 1 to 20 degrees and a top rake of from 12 degrees negative to 15 degrees positive. The tools work, and at varying depths of cut and varying speeds, but the best results are obtained only by the old "cut-and-try" method.

Carbide-tipped tools will work in any plant if the right man is assigned to the job of making the tools work. Don't assign him to the job of seeing if they will work, but to making them work. The fact that they work in hundreds of the country's largest plants is proof that they will work. A single tool can be used for making a cratering test on every type of material used in a shop. After the cratering test has proved that the carbide metal will cut the material, one need have no fear of the ultimate results. Experiments with tool angles and speeds will pay real dividends, and the superintendent will very likely be looking for machine tools that will deliver more speed.

* * *

American Engineering Council Urges Industry to Action

In a statement published by the American Engineering Council, 29 W. 39th St., New York City, the seriousness of the defects in our economic system that produce periodic depressions and unemployment is emphasized. "There is," says the announcement, "a very pronounced feeling that industry and commerce are largely responsible for the perplexities which have arisen, and that they should provide a satisfactory solution. This thought is not confined to any so-called 'radical' group, but prevails also among fair-minded, far-seeing people.

"They realize that unless industrial and commercial leaders deal successfully with the problem of unemployment, both the Federal and State Governments will very likely enact unemployment insurance laws. That such laws would be detrimental to the economic and social well-being of the nation is generally acknowledged. Whether this country escapes such consequences will depend entirely on the constructive leadership manifested by American industry and commerce.

"The Council emphatically believes that such legislation is neither the only nor the best solution. It feels that there is sufficient forward-looking, constructive and public-spirited leadership in American industry and commerce to make a serious study of the issues and on the basis thereof to develop plans for dealing permanently with unemployment, however caused, and further, so to stabilize employment as to hold unemployment to the irreducible minimum."

Forming Die that Imparts a Double Stroke to the Punch

Unusual Method of Producing a Formed Part, which, Because of its Simplicity, Enables an Efficient Die to be Designed with Comparatively Few Working Parts

By H. R. SCHMIDT

RECENTLY the problem of forming the butts on steel knitting machine needles like the one shown at *B* in Fig. 1 was encountered. To handle this work, the writer designed the die illustrated in Fig. 3. At *A* in Fig. 1 is shown the needle before the butt is formed. The three stages of bending required in forming the butt are shown in Fig. 2. At *A* a punch forms the wide ear to a U-shape. The punch then recedes and two side bending fingers move inward, as shown at *B*, and bend both sides of the large ear toward each other, after which the punch again moves forward, as indicated at *C*, and flattens these sides against the narrow ear.

It is apparent that the punch is required to move against the needle twice in order to form the butt completely. This double movement of the punch is obtained through the action of a toggle joint mounted on the left-hand end of the die (Fig. 3). The upper link of the toggle is pivoted to the punch-block and the link at the right is pivoted to a horizontal slide carrying the forming punch *A*. Obviously, this punch will be moved toward needle *B* once during the descent of the ram and once during its ascent.

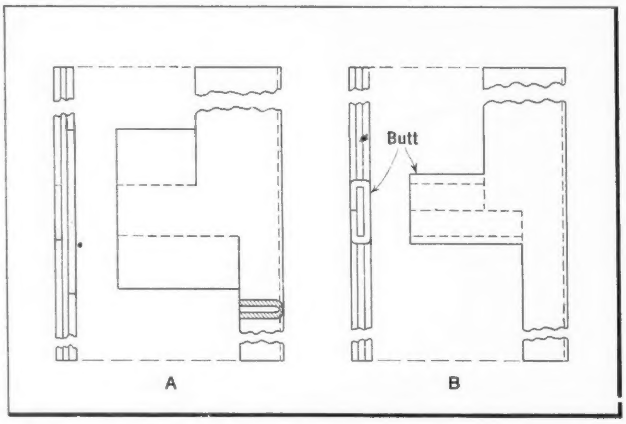


Fig. 1. Knitting Machine Needle Having a Butt which is Formed in the Die Shown in Fig. 3

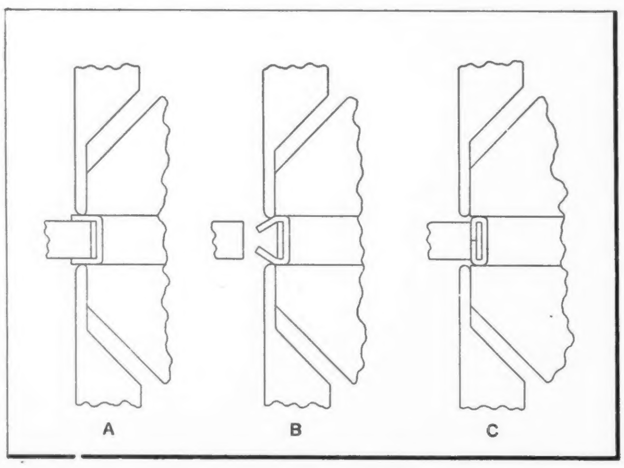


Fig. 2. Three Stages in Bending Required to Form the Butt of the Knitting Machine Needle Shown in Fig. 1

The remaining parts of the die consist chiefly of the stationary die *K* and the two slides *F* to which the side forming fingers *E* are attached. These slides are moved laterally on the downward stroke of the press, against the pressure of rubber buffers, by the cams *G* which enter between the ends of the slides and the stationary blocks *H*. Sliding bar *L* serves both as a forming pad and an ejector. One end of this bar is normally flush with the faces of the forming fingers *E*, while its other end is pinned to the sliding block *M*. The bar is prevented from ejecting the work after the first forming stroke of the punch by the cam *N* entering between the end of the die *K* and the sliding block *M*. A rubber buffer is provided also to carry the bar *L* back to its original position when cam *N* ascends. The pressure of the rubber is constant. The screw *Q* provides a final stop for the forming pad. The thickness of the butt can be controlled, within reasonable limits, by adjusting this screw.

In operation, a needle is located between the stops *D* and *C* and the faces of the side forming fingers *E*. As the press ram descends, the punch forms the large ear of the needle to a U-shape between the ends of forming fingers *E*. In the meantime, bar *L* has been forced, with the punch and ear, to a position at the right, and is locked in this position by the cam *N* entering between the die and the sliding block *M*. The lower links of the toggle joint are now in a straight line and as the ram continues to descend the punch will recede. However, the needle will be prevented from following the punch by the forked stripper plate *P* which is attached to the punch-block. While the punch is receding, the fingers *E* move toward each other and bend the sides of the large ear inward, as indicated at *B* in Fig. 2.

The press ram now begins to ascend, causing the lower links of the toggle to straighten out once more and again force the punch *A* against the butt. This time, however, the sides of the large ear are

flattened out against the narrow ear until the butt takes the form indicated at C in Fig. 2. Now as the ram continues to ascend, the cam N leaves the die and block M, allowing the bar L to eject the finished butt from the die.

The principles involved in this design should be applicable in many instances where similar work is encountered by the tool engineer.

The Cheerful Side

The Young Radiator Co. of Racine, Wis., manufacturer of radiators for internal combustion engines as well as for other purposes, reports greatly increased activity during the last three months. In September and October the company employed both day and night shifts in several departments.

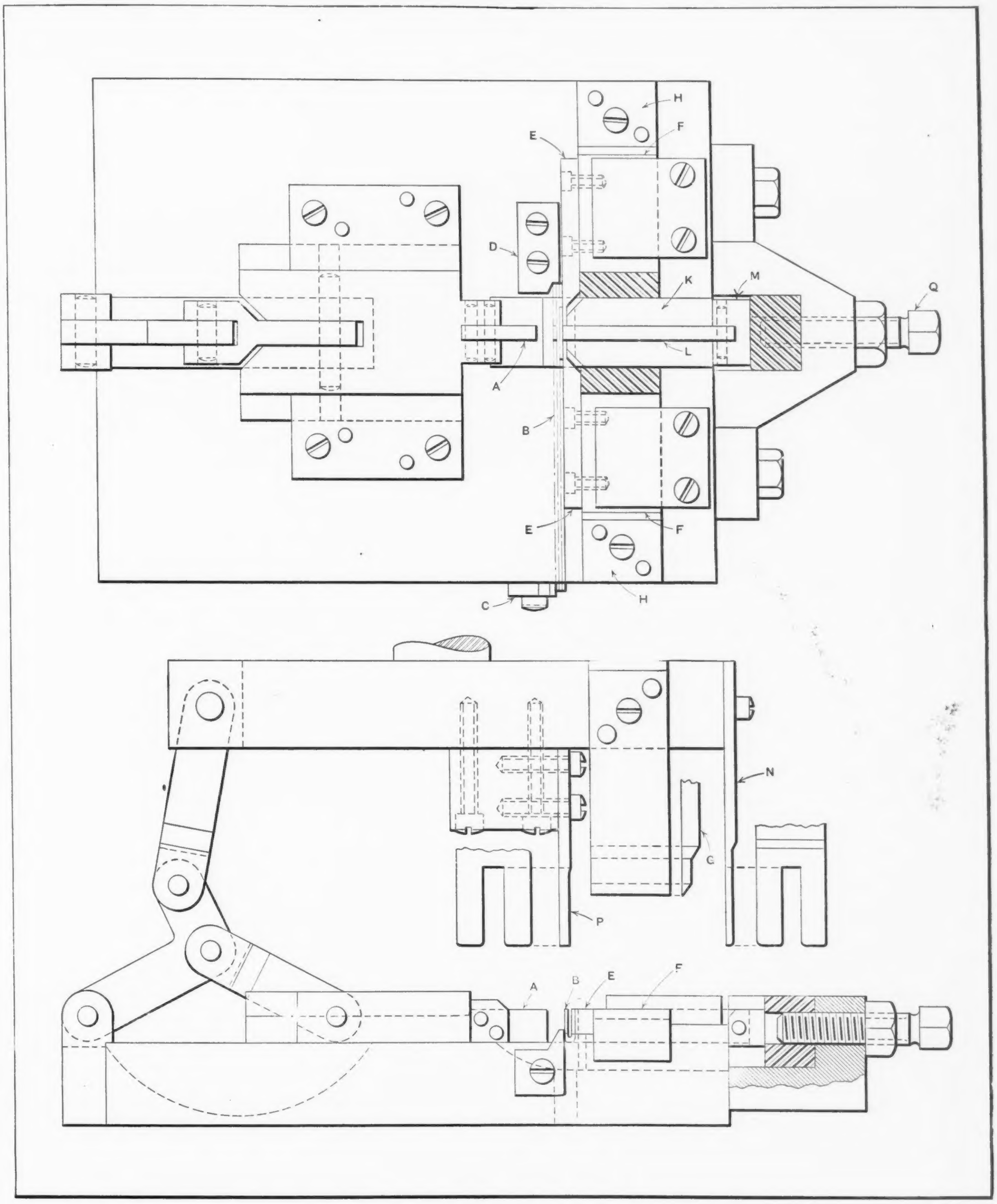


Fig. 3. Die for Forming the Butt on the Part Shown in Fig. 1. Two Strokes of the Punch are Obtained for Each Stroke of the Press Ram

Automatic Arc-Welding Applications

Methods of Adapting Automatic Welding Head to Production and Special Welding Work

By A. M. CANDY, General Engineer
Westinghouse Electric & Mfg. Co.

THE advantages of arc welding and the quality and reliability of arc-welded products have become well known. Manufacturers are now beginning to turn their attention to finding a more economical means of applying this process to different classes of work. Probably the most important step in this direction has been the development and application of the automatic arc-welding head. One of these units, such as shown in Fig. 1, with the addition of a suitable traversing mechanism, can reproduce any desired weld any number of times without readjustment after the initial setting is made.

The welding head automatically strikes the arc and then maintains the required arc voltage, feeding the electrode into the arc from a 100- or 200-pound reel of wire. It is readily adaptable to any type of welding, including butt welding, fillet welding, or building-up processes, and it materially increases the range of application to light sheet-metal welding.

Four variable factors are involved in the application of arc welding to any job, namely, electrode diameter, welding current, arc voltage, and travel speed. In general, the electrode diameter for automatic welding is only slightly increased over that used in manual welding for the same application, and often an electrode of the same diameter can be used. The increased speed of automatic welding is usually obtained by increasing the current density.

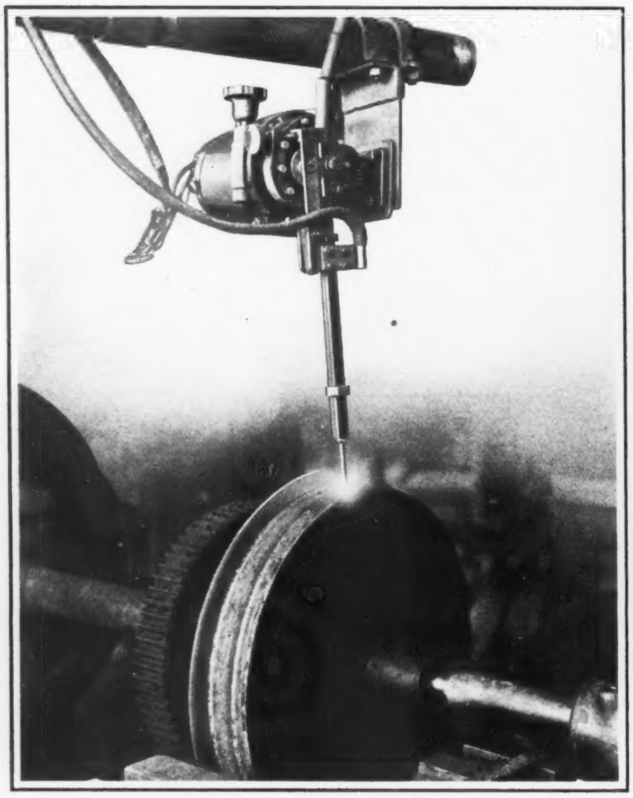


Fig. 1. Building up Tread of Mining-car Wheel with an Automatic Welding Head

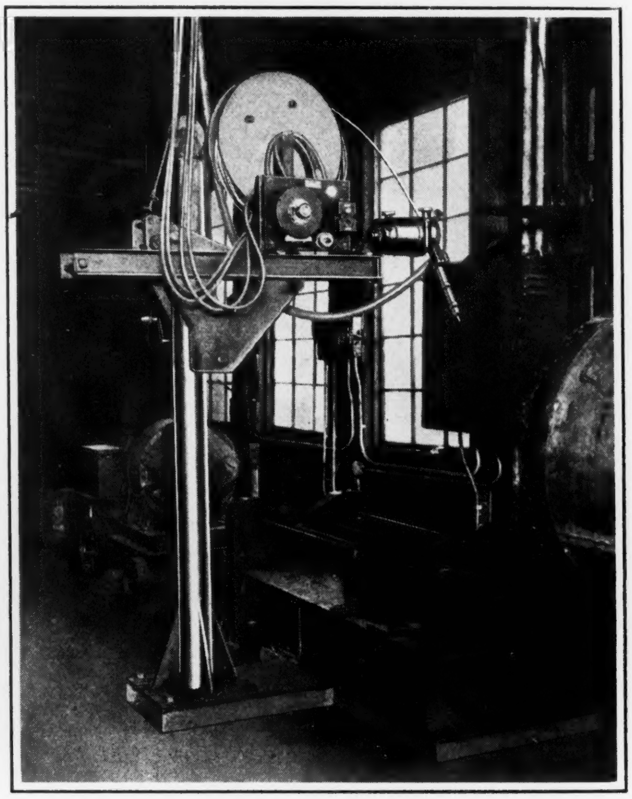


Fig. 2. Automatic Welding Equipment Used for Joining Sections of Well Casing

About 10,000 amperes to a square inch of electrode cross-section is ordinarily used for hand-welding, but it is not uncommon to use 25,000 amperes per square inch for automatic welding. This higher current density increases the penetration and fusion, and also gives much greater arc stability for welding at high travel speeds. The arc voltage is substantially the same as that recommended for hand-welding, but the automatic welding head is much more successful in maintaining the desired arc voltage, and, as a consequence, produces a more uniform weld.

The travel speed obtained by some type of mechanical drive, either for the welding head or the work, must be uniform and constant. It may be from three to six times faster than hand-welding speeds, depending on the application. This uniform motion of the electrode is also an important factor in obtaining consistently good welds.

The automatic welding head shown in Fig. 1 was developed by the Westinghouse Electric & Mfg. Co. It has an automatically regulated motor which feeds the electrode to the arc through the long nozzle. The welding current is picked up by the electrode through contact with the interior of the nozzle. The motor which provides the feed for the electrode is regulated by a control system located in a cabinet that is separate from the welding head and the work-handling equipment. A small operator's panel, within convenient reach of the welding head, contains the "start" and "stop" push-button, the arc voltage control rheostat, and the voltmeter for indicating the arc voltage. The welding current is, of course, controlled at the welding generator or welding circuit control panel.

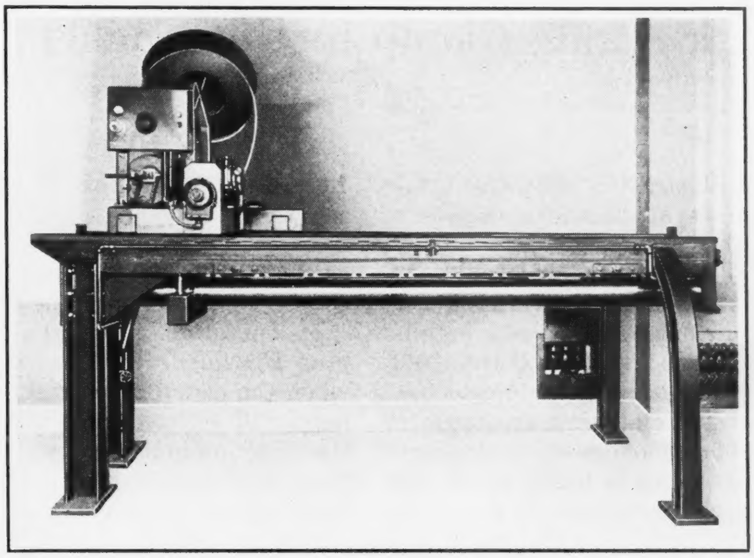


Fig. 3. Westinghouse Eight-foot Seam Welder, Suitable for Welding All Types of Tanks and Pipe

Building up Worn Locomotive Tires

The illustration Fig. 1 shows how one of the automatic welding heads is employed for building up the worn tires of mining locomotive wheels. Deep grooves are worn in the tires of these wheels by the large amount of abrasive material found on the rails in the mines. Building up the tires by automatic welding in this way and machining them to size has proved to be much cheaper than making replacements.

The wheels and axles to be built up are mounted in an old lathe, geared down to the proper speed. Any other suitable means can, of course, be used for rotating the wheels while the automatic welding head is in operation. Once the arc is started, it need not be stopped until a sufficient number of beads have been deposited to fill the worn tread and to leave enough material for the subsequent machining operation.

The welding is done at a surface speed of 11 inches per minute, which provides a uniform heat distribution. For this reason, little difficulty is experienced from residual stresses. On this particular application, bare wire, 3/16 inch in diameter, is used with a current of about 200 amperes. In building-up work, it is generally more satisfactory to deposit a large number of small beads than a smaller number of large beads with a larger wire and high current.

In Fig. 3 is shown a Westinghouse automatic seam welder which is adaptable to the manufacture of all types of tanks and pipe where a straight seam is to be welded. Work up to 8 feet in length can be handled on this machine, although similar designs are made for work up to 30 feet in length. The frame is of arc-welded structural steel, and includes the backing bar and air-operated fingers for holding the sheets firmly in place during the welding operation. The track on which the carriage of the welding head travels is parallel to the seam to be welded.

The operator's panel, the coil of welding wire, the carriage driving unit, and the travel speed control rheostat are mounted on the travel carriage with the automatic welding head. Although this is a production tool, it requires only a few minutes to change the set-up for welding 1/2-inch plate, using 1/4-inch wire, to a set-up for welding No. 23 gage material, using 1/16-inch wire. This equipment will decrease the welding time to about one-half that required by manual welding on the heavier materials. On light-gage materials, such as 16 gage, the time will be reduced to about one-sixth that required for hand-welding. Of course, on No. 20 and lighter gage material, hand-welding cannot compete at all with automatic welding. The minimum diameter of a tank or pipe that can be welded on such a machine is limited only by the diameter of the backing bar, while the maximum diameter is limited only by the clearance beneath the backing bar.

Equipment for Making Circumferential Welds

The equipment shown in Fig. 2 is used to weld several sections of well casing together, the longitudinal seams of which have been welded on a seam welder such as shown in Fig. 3. The equipment shown in Fig. 2 consists of two sets of rolls which, together, handle work ranging from 8 to 36 inches in diameter. The rolls are driven through a reduc-

tion unit and a Reeves variable-speed drive. The welding head, the operator's panel, and the welding wire are supported on a pedestal arm which is adjustable both as to height and swing. The particular equipment illustrated is used to make a 3/16-inch lap weld at the rate of 10 inches per minute, using an electrode 3/16 inch in diameter and a current of 300 amperes.

Semi-Automatic Welding Equipment

A great saving in welding costs can be effected by the application of semi-automatic welding equipment to irregular joints and heavy welds made in a horizontal plane. Such equipment is readily provided by replacing the standard 15-inch rigid nozzle of the automatic welding head by a flexible tube about 5 feet in length. At the lower end of this tubing is a handle and nozzle for guiding the electrode. In the handle is a trigger switch for starting and stopping the welding head. Around the flexible tubing is braided a heavy covering of fine copper wire which carries the welding current to the nozzle where it is collected by the electrode through sliding contact. As the welding head is mounted overhead in such a manner as to keep the end of the nozzle at the correct distance from the work, the arc will be struck and maintained automatically. Thus the operator will merely have to guide the arc along the joint to be welded. This arrangement makes it possible to about double the welding speeds obtained by hand-welding, while an equally satisfactory joint is assured.

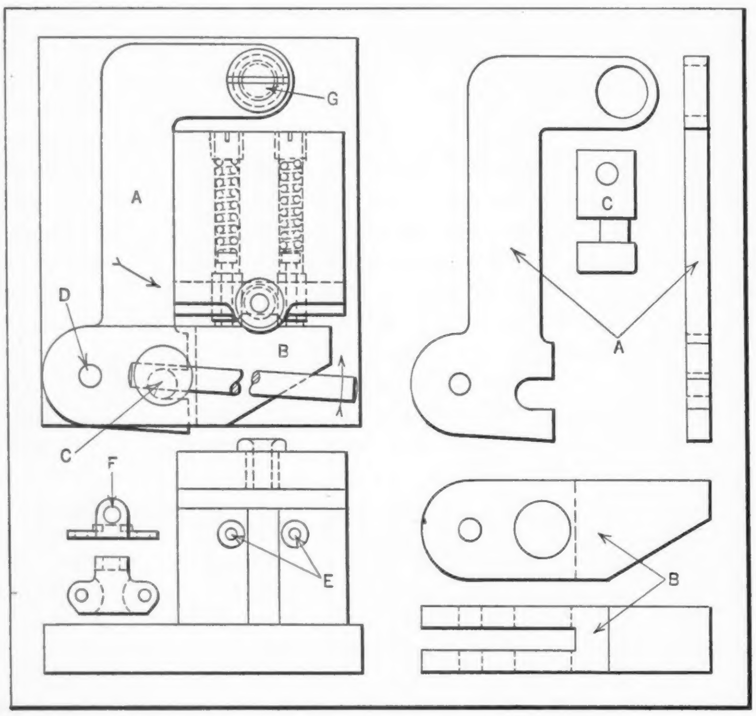
Quick-Acting Clamp for Jigs and Fixtures

By EUGENE L. SOLTNER

The accompanying illustration shows a quick-acting clamp that can be applied to a variety of jigs and fixtures. It has been used on a number of jigs and fixtures in our plant and found to be most efficient. In this case it is shown applied to a jig used for drilling the piece *F*. There is nothing particularly noteworthy about the fixture itself, aside from the manner of locating the piece.

The chief feature of the clamping arrangement is that it requires but one movement to secure or release the work. The clamp is made up of four parts—the arm *A*, the clamping jaw *B*, the eccentric *C* with its handle, and the fulcrum pin *D*. Eccentric *C* and its handle project above the clamping jaw high enough to provide clearance for the fingers. Fulcrum pin *D* is made the same height as the eccentric. This pin serves as a stop for the eccentric handle when the clamp is released.

In operation, piece *F* is located on the spring pins *E*, which recede within the body of the jig when the clamp closes on the work. Grasping the handle of eccentric *C* and pulling to the right, in the direction indicated by the arrow, serves to move the arm *A* into position. When the arm strikes the body of the jig, which arrests its movement, continued movement of the handle in the same direction turns eccentric *C*, which actuates jaw *B*. Jaw *B*, which is thus turned or pivoted on pin *D*, clamps the work securely. Moving the handle of eccentric *C* in the opposite direction releases the jaw *B*. This opening movement continues until the handle strikes pin *D*, when continued movement carries arm *A* and the entire clamp out of the way, so that loading is easily accomplished. It is important that screw *G*, on which arm *A* swivels, be located on the same center line as the work.



Drill Jig Equipped with Quick-acting Clamp

* * *

A new ceramic material, known as "Crolite No. 7," which has the lowest coefficient of thermal expansion of any known material and is suitable for such purposes as spark-plug cores and pyrometer tubes, has been brought out by Henry L. Crowley & Co., West Orange, N. J. Previous to this, the alloy Invar has represented the lowest thermal expansion coefficient known, but the new ceramic material has a coefficient only one-half that of Invar.

Guarding Against Obsolescence in Management Methods

A Few Observations Intended to Show that Modern Management Methods are as Urgently Needed as Modern Machinery in the Shop

An Interview with JAMES W. HOOK
President, The Geometric Tool Co.

THROUGHOUT the country, there are many industries that are suffering from "old school" management. These are confined mostly to the smaller plants, where the founder of the business is still the active manager or where the present management has held the reins for too long a time. I recognize that this is a harsh thing to say, but I believe it is the truth.

Management is no longer a one-man affair. It depends upon the cooperation of every man and woman in an organization in thinking things through, making suggestions, and helping to formulate policies. Management in any modern successful company is a group proposition. Every man or woman in an organization who conscientiously directs his own efforts, or the efforts of others, is a part and parcel of management. The heads of the organization are, or should be, a sort of Supreme Court that keeps ideas that are fed up to them coordinated and consistent. The heads must have the tact to discard, without offense, ideas that in their judgment do not fit. And finally, they must never feel that they have reached the ultimate accomplishment, but must forever keep on trying to produce newer and better things to sell, and to offer finer and more satisfactory service.

One of the vital things that modern management must consider is to develop a mental attitude in the organization that will aid the management in reaching its objectives. The first question raised, of course, is this: How can the right kind of mental attitude be obtained? Every management wants it and is willing to go to great lengths to get it. The welfare departments in industry, the clubrooms, parks and playgrounds, elaborate housing plans, free medical and legal advice, and similar schemes are all evidences of efforts on the part of management to develop a friendly mental attitude in the employes. All these methods help, of course, but do they actually reach the heart of the men and women employed in industry? I am inclined to doubt it. I believe that gifts of this kind to an organization have a tendency to make the employe lose respect for the firm.

The average men and women in this world are not looking for something for nothing, and most of them are suspicious of offers of that kind; but all men and women engaged in industry like to feel that they are having a part in the growth of the business with which they are connected. It is human nature to desire to express oneself, and the more one learns, the more persistent this desire

James William Hook was born in Iowa in 1884. He graduated in mechanical engineering from the Iowa State College in 1905, and was awarded a master's degree from the same college in 1912. After having been connected as engineer and sales manager with several Iowa concerns, he became associated with the Allied Machinery Co. of America in New York in 1916, first as vice-president and later as president and director. This company was an important supplier of essential war machinery to the allied countries, and during the war Mr. Hook was prominently identified with the large war activities of the American International Corporation. In 1923 he left the Allied Machinery Co. of America and acquired a controlling interest in the Geometric Tool Co. of New Haven, Conn., becoming president and general manager of that company. He is a director of the Acme Wire Co. and the First National Bank and Trust Co. of New Haven, a member of the New England Council, and chairman of the Council's industrial committee. He is also chairman of the Connecticut Unemployment Commission and a member of the President's Organization on Unemployment Relief, activities to which he has given much time and effort.

becomes. Many managers and foremen crush the desire of their subordinates to express themselves. Many a profitable idea has been lost forever, because of this narrow attitude on the part of those in charge.

Do Not Frown upon the Suggestions of Subordinates

I believe in urging men to give voice to their constructive views on ways to improve methods and build business. I believe that these suggestions should be cordially accepted, and, whenever possible, tried out. When practicable, a man should be given a chance to see his idea in action. If the results are not successful, he will have learned a valuable lesson.

Let a man have his own way every time you possibly can, so long as that way is in the line of constructive and positive effort, and you not only build the man and bring out the best that is in him, but you also learn many things yourself, and enlarge the mental capacity and constructive genius of your whole organization. No business nowadays can succeed if it does not utilize the composite brain power of every employe from the top down, and direct and lead it into channels of group constructive effort.

Further, make every department head feel that it is his duty to push the top management for everything that will reduce costs or improve the product. The top management needs this stimulus, and will get into a rut as quickly as the remainder of the organization if it is not forthcoming.

A business seldom fails because of its organization. It often fails because of its leadership. The organization mind never sympathizes with bad management or useless positions and departments, but it will not assert itself if the top management is not willing that it should. Thus we can lay the cause of most failures right on the man at the top.

Foremen Should be Coached to Adopt a Receptive Attitude

It is not an easy thing to get foremen and sub-foremen in the shop to follow the policy of listening to ideas from the workmen. Frequently, a new idea is turned down rather roughly, especially if it appears at first sight to be impracticable. I have seen many cases where workmen's ideas have been turned down only to find later that these ideas could be put to successful use.

When men are given an opportunity to feel that they are working *with* the company and not only *for* the company, the right mental attitude will be created. To accomplish this, the personnel of a company must be given an opportunity to learn something about what is "going on." This can best be done by keeping the shop executives informed, and making them, in turn, convey information to the men in their departments.

The salesmen, for example, can be brought in from time to time and posted on the new things the company is doing, its new policies, new methods of serving customers, and new mechanical developments. The shop executives should be brought into conference with the outside men. This keeps the shop men in touch with what is taking place on the outside and gives them an opportunity to know how the product of the plant is considered by the trade. This information can be passed on to the men in the shop. A shop force must be made to feel its responsibility to the company's customers. It must learn that by far the greatest portion of all resistance to the sale of any manufactured product is removed before the goods leave the shipping room.

When everybody around the plant is thoroughly imbued with that idea, the right mental attitude is insured. A company having succeeded in establishing such a spirit is practically certain of continued success.

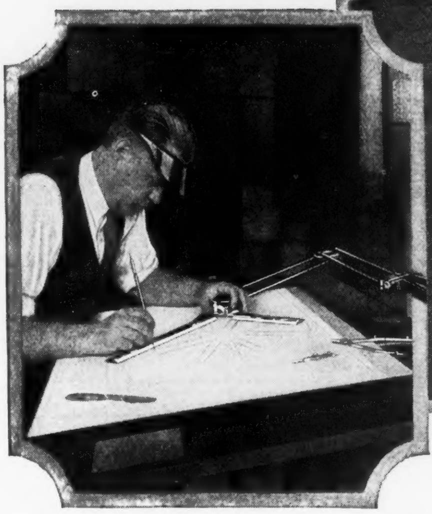
* * *

Selecting the Right Lubricant

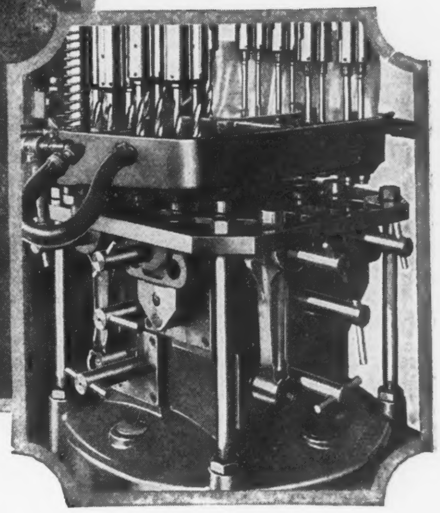
Too often the price per gallon governs the choice of the lubricant used for industrial purposes. In January MACHINERY, G. L. Sumner, oil engineer of the Westinghouse Electric & Mfg. Co., has some important things to say on the subject of lubricants and maintenance costs. He shows that the higher priced oils are frequently cheaper than cheap oils. The full price of the latter is not paid for on a cash basis, but is paid for, sooner or later, in increased power costs, excessive wear, interrupted service, breakdowns, repairs, and sometimes in the complete ruin of expensive machinery. In coming numbers of MACHINERY Mr. Sumner will deal with various phases of the lubrication problem.

The General Electric Employment Plan

About 90 per cent of the employes of the General Electric Co., by a general vote, have accepted the provisions in a new employment plan offered by the company to its employes; this plan affects about 39,000 men and women. The plan provides for rotation of available work and other means by which employes working at hourly rates or on piece-work will be assured of receiving, during the six months beginning November 1, not less than the equivalent of one-half of their average full-time weekly earnings, provided this one-half amounts to $15 a week, and their actual earnings in case these amount to less than $15 per week. Those employes who earn 50 per cent or more of their average full-time earnings, including all office, administrative, and executive employes and officials of the company, will contribute 2 per cent of their earnings to the unemployment fund, the company contributing an equal amount. In case the funds thus raised should prove inadequate, the board of directors will be asked to authorize additional payments by the company, without additional payments by the employes.



Design of Tools and Fixtures

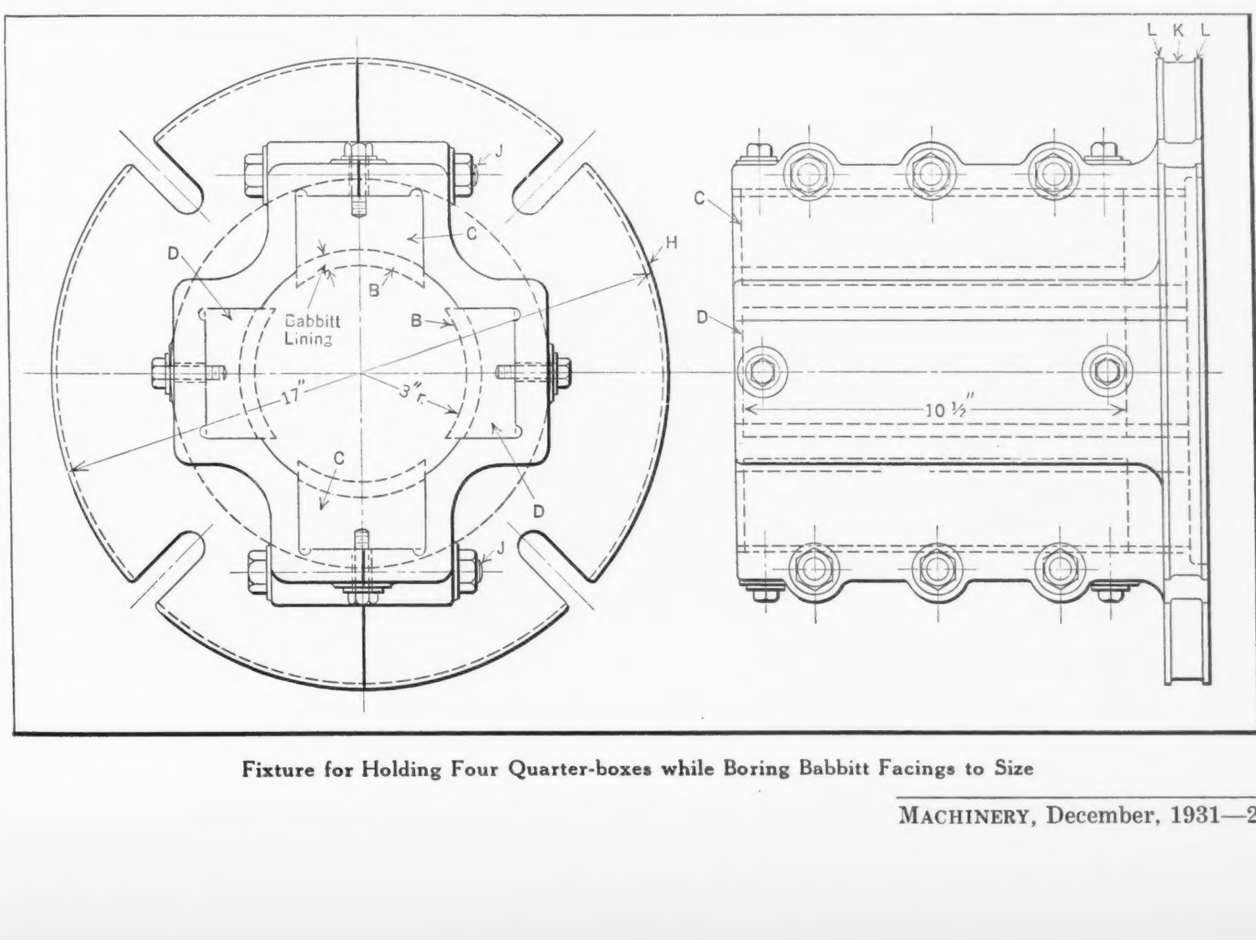


Boring the Babbitt Linings of Four Quarter-Boxes Simultaneously

By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

The fixture shown in the accompanying illustration provides a simple and accurate means of holding two pairs of cast-iron quarter-boxes *C* and *D* on a lathe faceplate while boring the babbitt linings *B* to the required 3-inch radius. These boxes are used in the main bearing of a horizontal compressor, and are made interchangeable to facilitate assembly and replacement. The box *C* for the front of the bearing is thicker than the rear box *D*. The boxes are planed at the ends, sides, and bottom, the bottom also being drilled and tapped to permit cap-screws to be used for holding the work in the fixture, as shown in the illustration.

The fixture consists of two symmetrical castings made from the same pattern and bolted together after machining, as shown at *J*. This split construction enables the work-locating surfaces to be machined easily in a shaper. The fixture can be used either on a lathe faceplate or on the table of a boring mill. No pilot is used, as there is not much danger of the fixture shifting under the light cuts taken on the soft babbitt facing metal. The accurately turned surface *K* between the protecting flanges *L* provides a means for accurately truing up the fixture on the machine.



Fixture for Holding Four Quarter-boxes while Boring Babbitt Facings to Size

Fixture for Testing Worms and Worm-Gears

By CLIFFORD CORNWALL, Toronto, Ontario, Canada

The fixture shown in Figs. 1 and 2 was designed for testing the smoothness with which the worm *C* operates with a master worm-gear *W* by observing the action of the indicator needle *I*. The total "run-out" can also be noted and the pitch diameter checked by comparative readings of the indicator. Worm-gears can be checked in a similar manner by using a master worm. Sets of worms and worm-gears produced in quantities may also be checked for center distance, smoothness of operation, and run-out.

The shoulder of the bronze bushing *A* takes the end thrust of the worm. The compression spring *B* keeps the thrust in one direction, even when the direction of rotation of the worm is reversed. The worm *C*, whether integral with the shaft or mounted on an arbor, is turned by the ball-crank *D*. The slip bushing *E* is hardened and ground and fits into a hole in the body of the fixture which is large enough to permit the worm to pass through. A special set-screw *F* engages the milled slot *G* in the bushing. This slot permits the spring *B* to be compressed and provides for locking the bushing in place.

The worm-gear *H* rotates on a hardened and ground stud *J* with one hub in contact with the plate *K*. The spring *L* and knurled nut *M* prevent the worm-gear from being lifted when the worm is rotated in a direction that would tend to lift it out of contact with plate *K*. The compression spring *N* is held in place in the base by the plate *O*. This spring operates against the lower end of the stud *P* and exerts sufficient pressure on the slide *S* to keep the worm-gear in constant mesh with the worm. If it is desired to apply the test at a fixed center distance, a set-screw may be provided in the slide to serve as a stop, or a spacing block may be placed between the end of the slide and the bearing upright *R*.

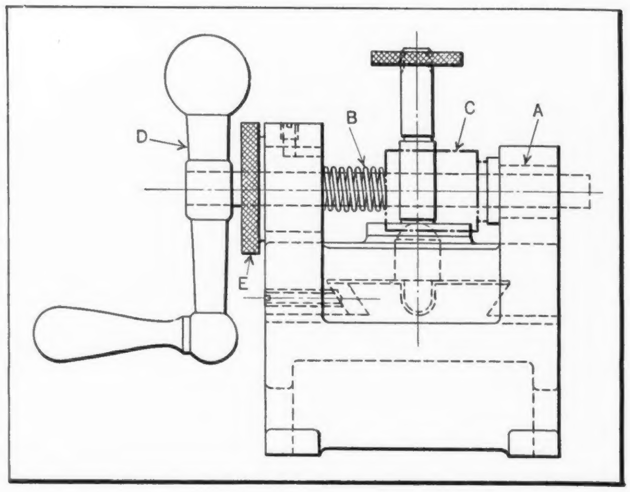


Fig. 2. End View of Fixture Shown in Fig. 1

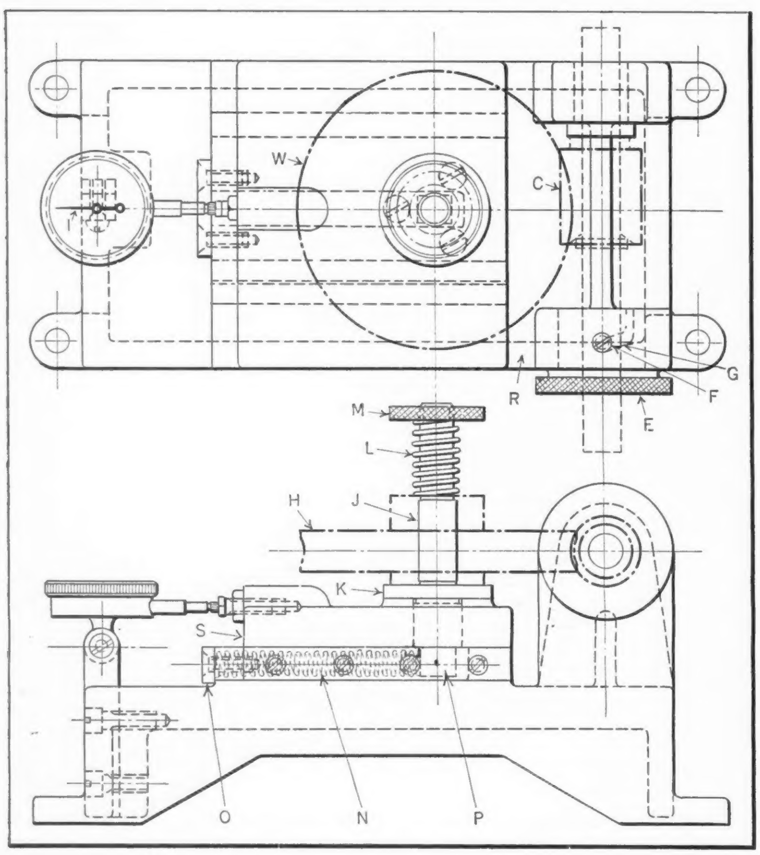


Fig. 1. Fixture for Testing Running Action of Worm-gears

Motor Shaft Jig with Special Locating Features

By J. E. FENNO, Belleville, N. J.

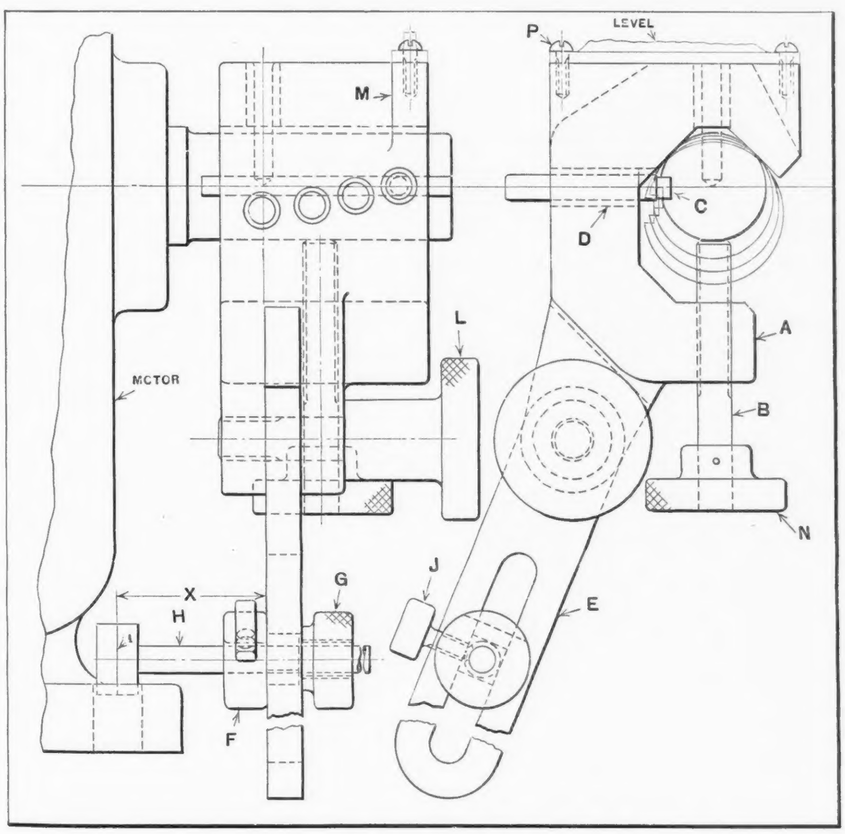
A jig that has greatly facilitated the drilling of lock-pin holes in four assembled motor shafts of different diameters is shown in the accompanying illustration. The holes—one in each shaft—must be drilled at an angle of 90 degrees to a center line passing through the keyway, and located a definite distance *X* from the center of the nearest hole in the motor foot.

Formerly, a simple jig was furnished for each shaft size, the jig being slipped over the shaft and lined up by the aid of a scale, spirit level, and square. However, this method proved awkward, and a jig incorporating special locating features was designed, as shown in the accompanying illustration. In the body *A* of the jig is milled a vee which seats on the shaft and is clamped to it by the screw *B*. The locating pin *C* is a slide fit in the four hardened bushings *D*, and has two diameters to suit the two keyway sizes cut in the different shafts.

The arm E is a swing fit in the lower end of the jig body, and is provided with an elongated slot in which the squared section of the bushing F slides. The knurled nut G, screwed on the end of the bushing F, serves to lock the bushing in place. The locating finger H is a slip fit in the bushing, and can be locked in position by the thumb-screw J. On one end of this finger is turned a head which is 1/8 inch narrower than the diameter of the smallest hole in the motor feet. The line I, scribed around this head, represents the center line of the hole in the motor foot, while the left side of arm E coincides with the center of the hole to be drilled. This permits the direct measurement of X with a scale.

Preparatory to drilling, the distance X is scaled and the finger H fastened by thumb-screw J. With both knobs G and L loosened slightly, the jig is slid along the shaft until the bottom of the head on finger H drops into the hole in the motor foot as shown, after which knob N is tightened. The jig is now adjusted until it is level, by the aid of the spirit level fastened to the top of rib M. Knobs L and G are then tightened, and the hole drilled. To prevent damage while not in use, open slots are provided for the screws P to facilitate the removal of the level.

The four holes for the hardened bushings D were bored in a milling machine. Four disks having the same diameters as the motor shafts were used to locate the bushing holes, and the table was adjusted vertically until the center of both disk and spindle coincided.



Motor Shaft Jig with Adjustable Locating Arm

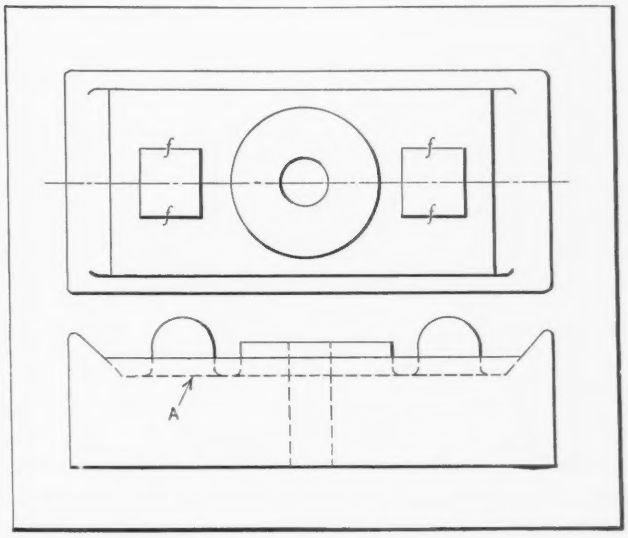


Fig. 1. Work on which Four Faces are Milled Simultaneously by Means of the Fixture Shown in Fig. 2

Fixture for Milling in a Bench Vise

By R. B. WILLIS

Straddle-milling the two small bosses on the plate shown in Fig. 1 in a standard milling machine would be a rather difficult job, inasmuch as the piece is ribbed in such a way that small-shank mills must be used to mill close to the surface A. The widths of the finished bosses are required to be held within limits of plus or minus 0.001 inch and the faces of the bosses must be machined an equal distance on both sides of the longitudinal center line within the same limits. As these pieces were made in small lots, an expensive fixture was not warranted; therefore, the simple vise fixture shown in Fig. 2 was constructed.

All the working parts of this fixture are mounted on the plate A, which has two V-grooves machined in it along its entire length. In these grooves are clamped, by means of the members E, four bushings F, which serve as bearings for an equal number of cutter-spindles. The spindles are driven by means of the pulley L on the shaft J through two trains of gears G, one at each end of the plate A.

In the work-holder D are secured two long bars C, which are a sliding fit in the flanged bushings attached to the back of plate A. These bars serve to guide the work-holder to and from the cutters. The work is supported in the holder by means of a center stud W, which passes through the work and holder and is tightened

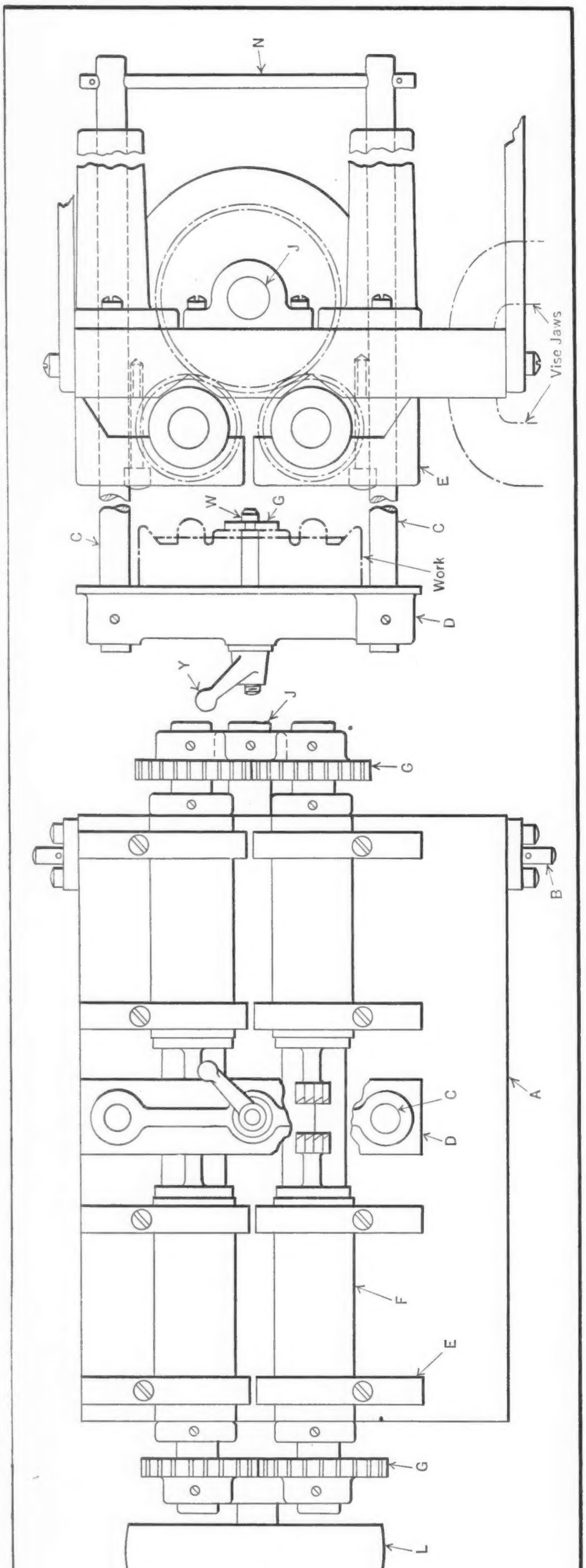


Fig. 2. Power-driven Fixture for Milling the Part Shown in Fig. 1

by means of the lever Y. A sliding motion is imparted to the work-holder by means of a hand-lever (not shown) which engages the connecting bar N. This hand-lever is fastened on the shaft B which is pivoted in the brackets shown extending from the side of the plate.

The fixture is clamped in its operating position in a bench vise, and power is provided for driving the cutter-spindles by means of a belt passing over a coupling on an overhead shaft. In operation, the work is placed in the holder as previously described, and the hand-lever is manipulated to move the work to the cutters.

In this way, all four faces on the work are milled simultaneously at one movement of the lever. To facilitate loading and unloading, a C-washer is provided for clamping the work. This washer engages a circular groove in the center stud and can be quickly removed. The bosses milled in this fixture are about 1/2 inch in diameter, and the actual time required for milling each piece is twenty-five seconds.

Combination Hand and Bench Riveter

By GEORGE A. FRIES, Philadelphia, Pa.

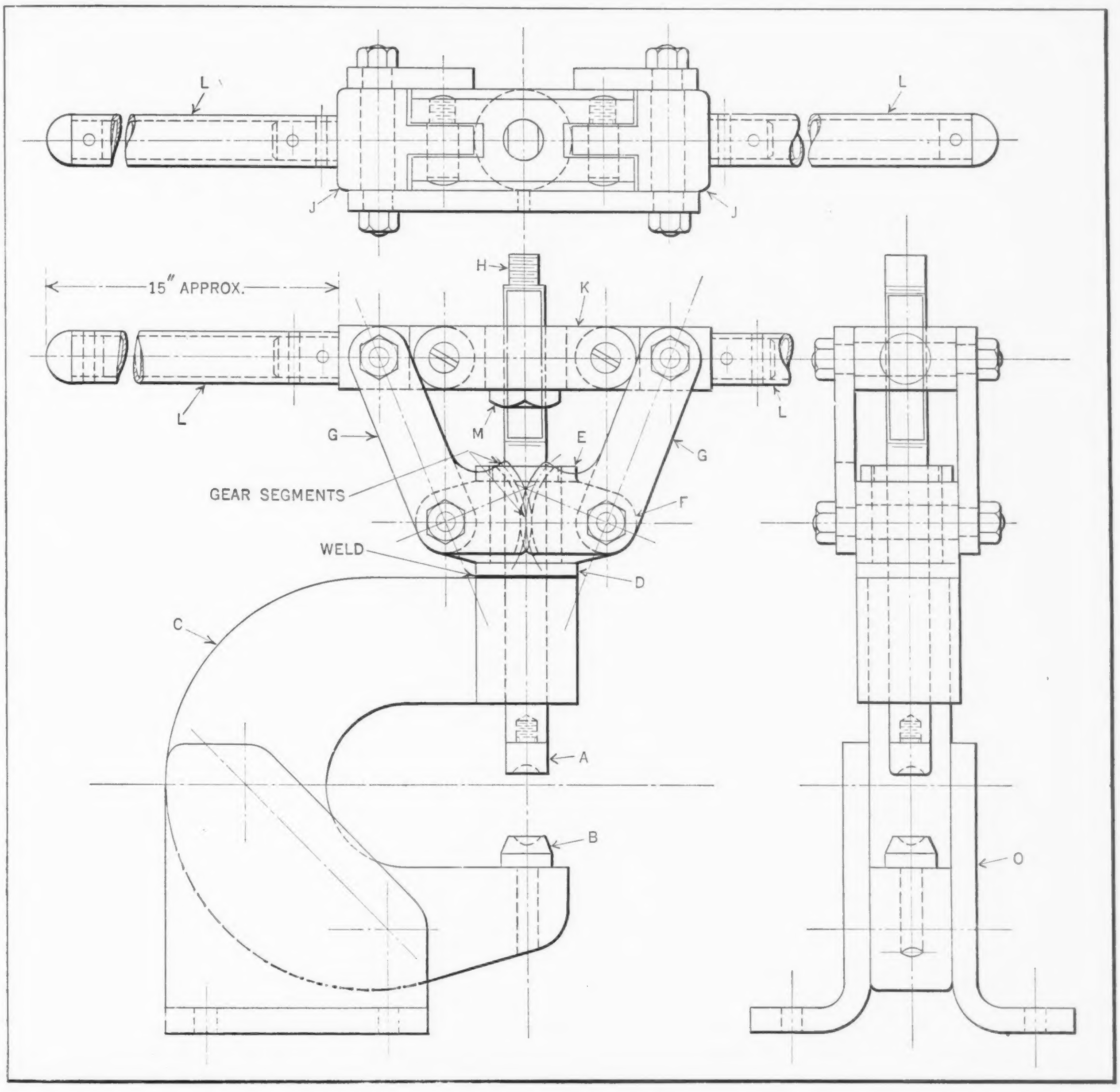
The riveting tool shown in the accompanying illustration has a capacity for heading rivets up to 3/16 inch in diameter by the application of a squeezing pressure obtained through hand-operated levers L and toggle links arranged as shown. Various sizes of rivet heads can be produced by providing interchangeable anvils A and B. The yoke C is designed to carry safely the stresses set up in forming the head of the rivet. To this yoke is welded a spool-like part consisting of two pieces, a body D and a cap E. The part F turns freely around the spool, so that the tool can be operated in the most convenient position.

The fulcrum studs on which the gear segment links G turn or pivot are located on the part F. The gear segments serve to equalize the pressure applied by the levers in case more pressure is applied to one lever than the other. These segments also keep the tool from shifting to one side, and thus prevent the rivet from being headed unevenly.

The levers L are constructed of tubing to reduce their weight. The ends of the fulcrum bearings J of the levers are connected by studs to the forked piece K. After being adjusted, the plunger can be locked by means of the lock-nut M, which also acts as a stop to limit the downward movement of the plunger H, by coming in contact with the face of the cap E. To operate the tool, the levers L

are moved upward, causing the piece K to move downward and exert great pressure on the anvil A through the plunger H.

The tool described was developed for use in the construction of aircraft members, for which the highest degree of efficiency must be maintained in order to enable the work to pass the rigid inspections to which they are subjected. This tool is economical to operate, and is light in weight and easy to handle. It can be kept in the tool-crib for use in the shop. Also, it can be used to advantage in the field, being especially adapted for emergency repair work. By applying the two supports O, it can be used as a bench tool. These supports are not required, of course, when the tool is used as a hand riveter. An important feature of this hand riveting tool is its freedom from vibration. It can, of course, be employed for a great variety of work other than aircraft construction.



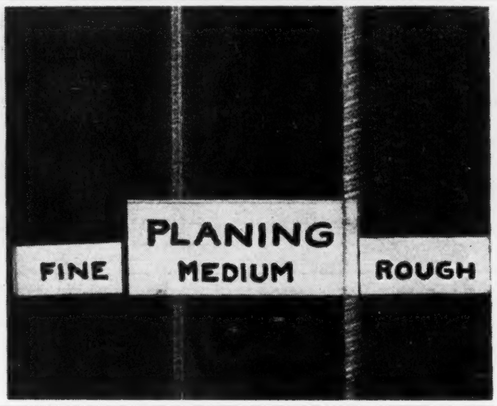
Hand-operated Tool for Forming Rivet Heads

Lubricating Exposed Gears

By W. F. SCHAPHORST, Newark, N. J.

Referring to a brief article on page 904 of August MACHINERY relating to the lubrication of exposed gears, in which a formula is given for mixing a lubricant that would have to be painted on the gears at intervals of five hours, the writer's experience has been that too many users of lubricants for purposes of this kind are attempting to "make their own." They think it is easy to make a good mixture from a given formula, and believe that they are saving money by so doing. It is seldom, if ever, that any money is saved. The reverse is usually the case. Money is lost, because the homemade lubricant is decidedly inferior to a lubricant that does not require repainting the gear teeth every five hours. Real lubricating oil stays put. Such oils are available on the market.

Is the Common Method of Specifying Finish on Drawings Expensive?



Sample of Planed Finishes Supplied to the Drawing-room and the Machine Operators to Avoid Misunderstandings

THE universal practice of using the letter "f" on drawings to indicate surfaces that are to be machined does not furnish the shop man with sufficient information. How is he to know whether a surface is to have a fine finish, a medium finish, or whether merely a rough cut will do?

In small shops, this matter may not be so important, because the machine operator can ask his foreman, and as the latter usually knows the exact function of the part, he is immediately able to give the requested information. In a large plant, however, time will be lost if the foreman has to consult the drawing-room to determine just how the part is to be used and the grades of finish required on the various surfaces. The chances are that the foreman will specify a fine finish everywhere in order to play safe. This means that the machining cost of many jobs will be higher than necessary.

Another common practice in drawing-rooms is to place some such note as the following on all detail drawings: "Unless otherwise specified, all finished surfaces must be to size within plus or minus 0.005 inch." This practice, too, causes many parts to be finished far more accurately than is necessary for the purpose, because the draftsmen neglect to mark the tolerances when they can be greater than the note calls for. The Norton Co., Worcester, Mass., has effected a saving of between $8000 and $12,000 per year by changing such a standard note to read that all finished surfaces must be to size between ± 1/64 inch unless otherwise specified.

The engineering department of this company also specifies whether each finished surface is to have a fine, medium, or rough finish. The letter "f" has been discarded in favor of small solid triangles which are placed with the apex touching the surface to be machined. One triangle indicates a rough finish; two triangles, a medium finish; and three triangles, a fine finish.

That there may be no misunderstanding as to what is meant by these different grades of finish, actual samples, finished as illustrated, have been supplied to the drawing-room and to machine operators throughout the shop. These samples have been made up not only for planing and turning, but also for grinding, shaping, side-milling, and face-milling. They are mounted on boards for convenient reference.

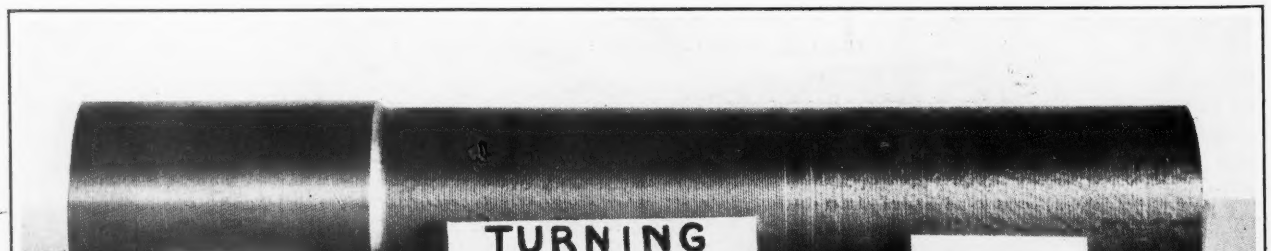
* * *

Drafting-Room Erasers

By JOHN E. HYLER

A wooden grip for an eraser, such as described in July MACHINERY, page 855, is a help in making erasures on ink tracings. Power-driven rotary erasers, however, are still better, and are made in different styles. One style has a motor mounted on a swiveling base which can be clamped to the drawing table, the eraser being mounted at the end of a flexible shaft. Another style, with the motor suspended from the ceiling, has two flexible shafts for ink and pencil erasers.

Another Sample that Shows the Differences Between Rough, Medium, and Fine Finishes on Turned Parts



MAGNESIUM ALLOYS—1

Designation of Dowmetal Alloys	Nominal Composition					Uses for which Alloys are Adapted
	Magnesium, Per Cent	Aluminum, Per Cent	Manganese, Per Cent	Cadmium, Per Cent	Copper, Per Cent	
F	95.7	4.0	0.3	...	...	Forging, rolling, and extrusion when maximum ductility is required
E	93.7	6.0	0.3	...	...	Castings requiring good strength without heat-treatment. Mechanically worked parts requiring both strength and ductility
A	91.8	8.0	0.2	...	...	High-strength heat-treated castings. Mechanically worked parts requiring maximum strength.
T	91.8	2.0	0.2	2.0	4.0	Pistons and other parts requiring maximum thermal properties
M	98.5	...	1.5	...	...	Maximum corrosion resistance—primarily for cast and fabricated parts not subjected to maximum stresses
G	89.9	10.0	0.1	...	...	Heat-treated castings where high yield point and hardness are very important

Physical Properties of Magnesium and Dowmetal Alloys

Magnesium or Dowmetal Alloy	Specific Gravity	Weight, Pounds per Cubic Inch	Melting Point, Degrees F.	Coefficient of Thermal Expansion per Degree F.	Thermal Conductivity, C.G.S. Units
Magnesium	1.74	0.063	1,204	0.000016	0.38
F	1.76	0.064	1,155	0.000016	0.23
E	1.78	0.064	1,135	0.000016	0.20
A	1.80	0.065	1,120	0.000016	0.18
T	1.82	0.066	1,185	0.000016	0.30
M	1.76	0.064	1,200	0.000016	0.30

MACHINERY'S Data Sheet No. 215, New Series, December, 1931

Based on article in S.A.E. Journal by John A. Gann

MAGNESIUM ALLOYS—2

Mechanical Properties of Sand-cast Dowmetal Alloys, Based on Standard Unmachined 1/2-inch Test Bars (Composition given in Data Sheet No. 215)

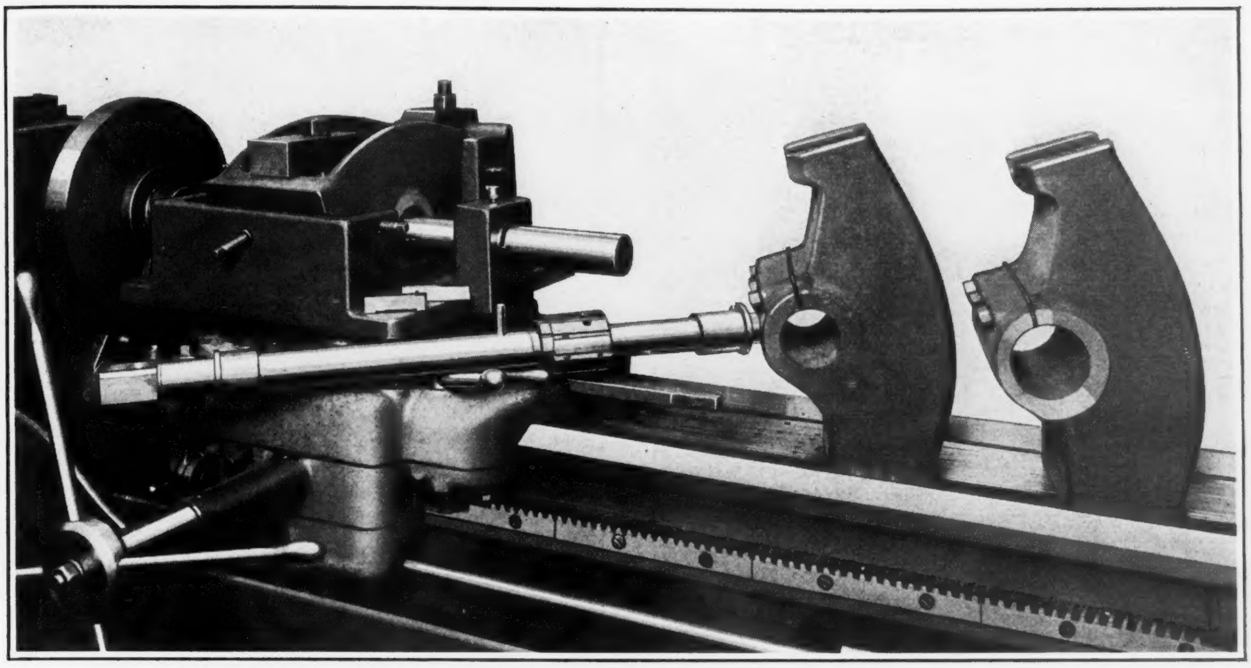
Designation of Alloy	Tensile Strength, Pounds per Sq. In.	Yield Point, Pounds per Sq. In.	Elongation in 2 Inches, Per Cent	Compression Strength, Pounds per Sq. In.	Shear Strength, Pounds per Sq. In.	Brinell Hardness	Comparative Impact Toughness
Dowmetal E, Not Heat-treated	28,000 to 31,000	7,000 to 8,000	9 to 12	40,000 to 42,000	13,000 to 15,000	46 to 50	7 to 9
Dowmetal A, Not Heat-treated	24,000 to 27,000	8,000 to 10,000	4 to 7	41,000 to 44,000	14,000 to 16,000	48 to 52	3 to 5
Dowmetal A, Heat-treated	31,000 to 35,000	8,000 to 10,000	9 to 12	42,000 to 45,000	14,000 to 16,000	48 to 52	9 to 12
Dowmetal T, Not Heat-treated	22,000 to 25,000	6,000 to 7,000	4 to 7	38,000 to 40,000	13,000 to 15,000	43 to 48	3 to 4
Dowmetal G, Heat-treated	33,000 to 38,000	17,000 to 20,000	1 to 3	47,000 to 51,000	15,000 to 17,000	70 to 80	2 to 3

Mechanical Properties of Fully Worked Wrought Dowmetal Alloys, Based on a 90 Per Cent Reduction in Area (Composition given in Data Sheet No. 215)

Designation of Alloy	Tensile Strength, Pounds per Sq. In.	Yield Point, Pounds per Sq. In.	Elongation in 2 Inches, Per Cent	Compression Strength, Pounds per Sq. In.	Shear Strength, Pounds per Sq. In.	Brinell Hardness	Comparative Impact Toughness
Dowmetal F	37,000 to 41,000	26,000 to 30,000	12 to 16	57,000 to 60,000	17,000 to 19,000	45 to 50	14 to 16
Dowmetal E	40,000 to 44,000	28,000 to 32,000	10 to 15	58,000 to 62,000	17,000 to 19,000	50 to 55	15 to 18
Dowmetal A	42,000 to 48,000	28,000 to 32,000	8 to 12	60,000 to 65,000	18,000 to 20,000	54 to 58	11 to 15
Dowmetal T	38,000 to 42,000	27,000 to 31,000	5 to 9	50,000 to 55,000	17,000 to 19,000	45 to 50	6 to 8
Dowmetal M	38,000 to 42,000	22,000 to 25,000	5 to 8	45,000 to 50,000	15,000 to 17,000	38 to 42	10 to 12

MACHINERY'S Data Sheet No. 216, New Series, December, 1931

Based on article in S.A.E. Journal by John A. Gann



Machining an Adjustable Arm Having a Split Bearing

Methods Used in Machining an Arm Having a Split Bearing for Rigidly Clamping it to a Bar

By H. T. LAFFIN, Jones & Lamson Machine Co. Springfield, Vt.

THE casting shown being machined in the illustrations is the back arm of a Fay automatic lathe on which tools for facing and forming are mounted. This arm is required to be a good sliding fit on the back bar of the lathe, and it must be provided with means by which it can be clamped securely in any position desired.

The casting for the back arm comes to the shop from the foundry with the bearing hole cored out to a diameter of about 3 3/8 inches. This hole must be bored to a diameter of 3.687 inches within plus 0.001 inch. The casting must be split to allow the bearing hole to be expanded sufficiently to admit the back bar and to provide clearance for clamping.

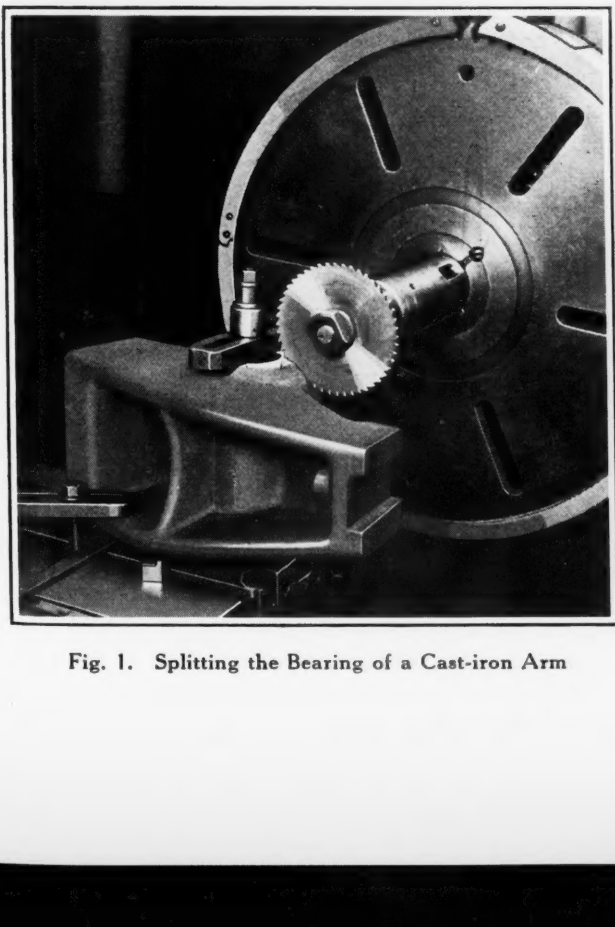


Fig. 1. Splitting the Bearing of a Cast-iron Arm

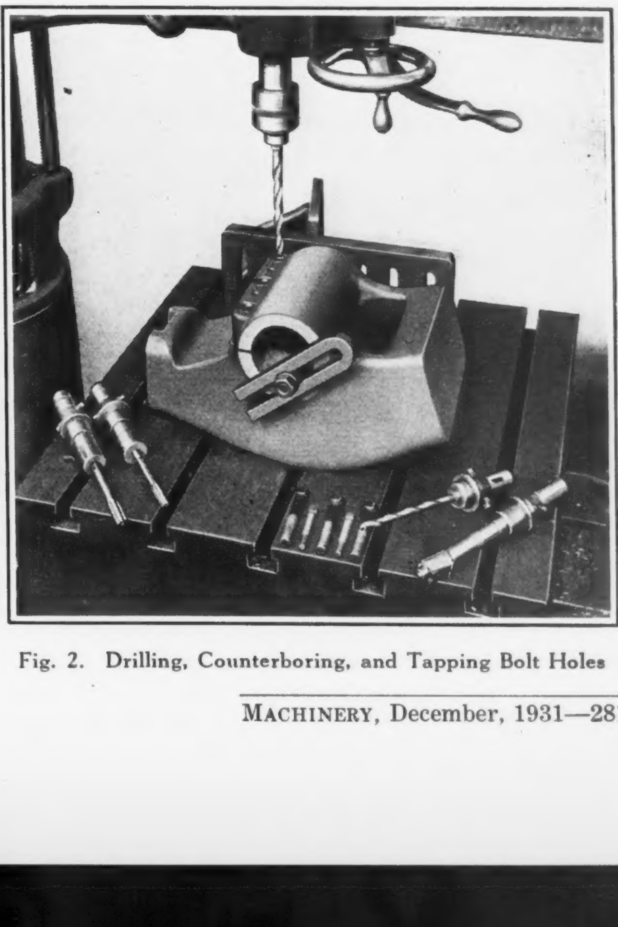


Fig. 2. Drilling, Counterboring, and Tapping Bolt Holes

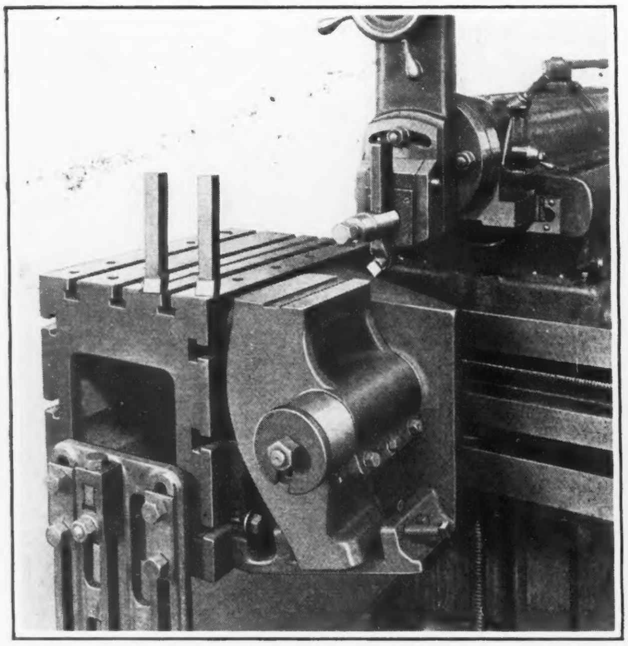


Fig. 3. Machining the Top Surface of Arm on a Shaper

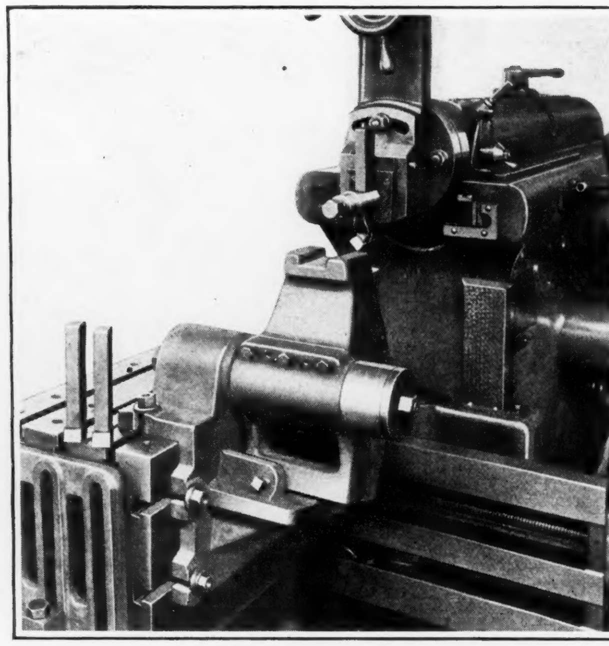


Fig. 4. Finishing Bottom End of Arm and Slot

Three tapped holes are provided for the clamping or tightening bolts. Two tapped holes are also provided for spreading bolts. If the bearing hole is bored before the splitting cut is taken, spreading or tightening at the slot will cause the hole to become distorted. Therefore the first operation consists of sawing or splitting the casting, as shown in Fig. 1.

The clamping and spreading holes are then drilled and tapped, the work being clamped to an angle-plate mounted on the table of a drill press, as shown in Fig. 2. A shim 0.005 inch thinner than the gage of the saw used for splitting the casting is placed in the slot and the clamping bolts tightened so that the sides of the slot are tightened against the shim. The work is then taken to the turret lathe shown in the heading illustration, where it is placed in a special fixture for rough- and finish-boring and reaming the hole and facing both sides.

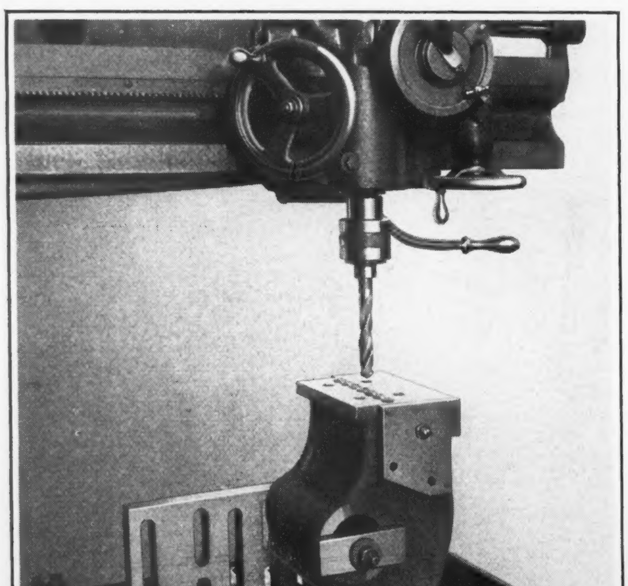


Fig. 5. Drilling Top of Arm on Radial Drill

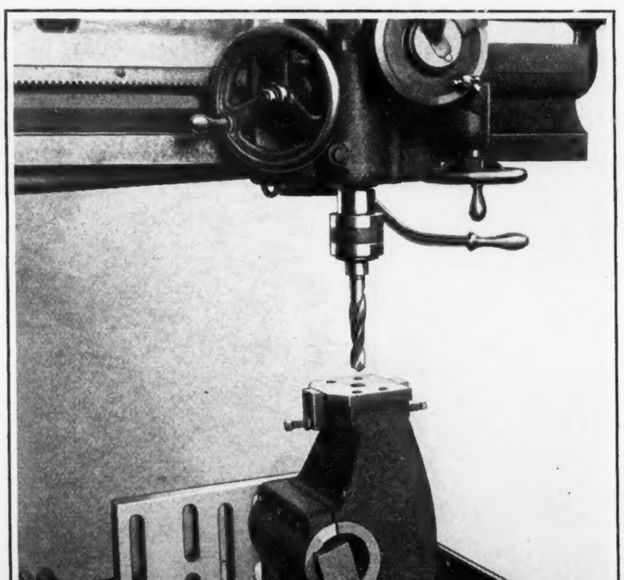


Fig. 6. Arm with Drill Bushing Plate in Place

The reason for using a shim 0.005 inch thinner than the normal thickness of the slot is to provide enough clearance between the bar and the hole to enable the back arm to be moved on the bar readily when the clamping bolts are loosened without resorting to the use of the spreading screws. The spreading screws are used, of course, when the back arm is being removed from the bar. The fixture used for holding the piece during the turret lathe operations is fastened directly to the lathe turret. It carries two supporting bushings for the boring-bar, which is driven by a standard-nosed faceplate through a universal joint.

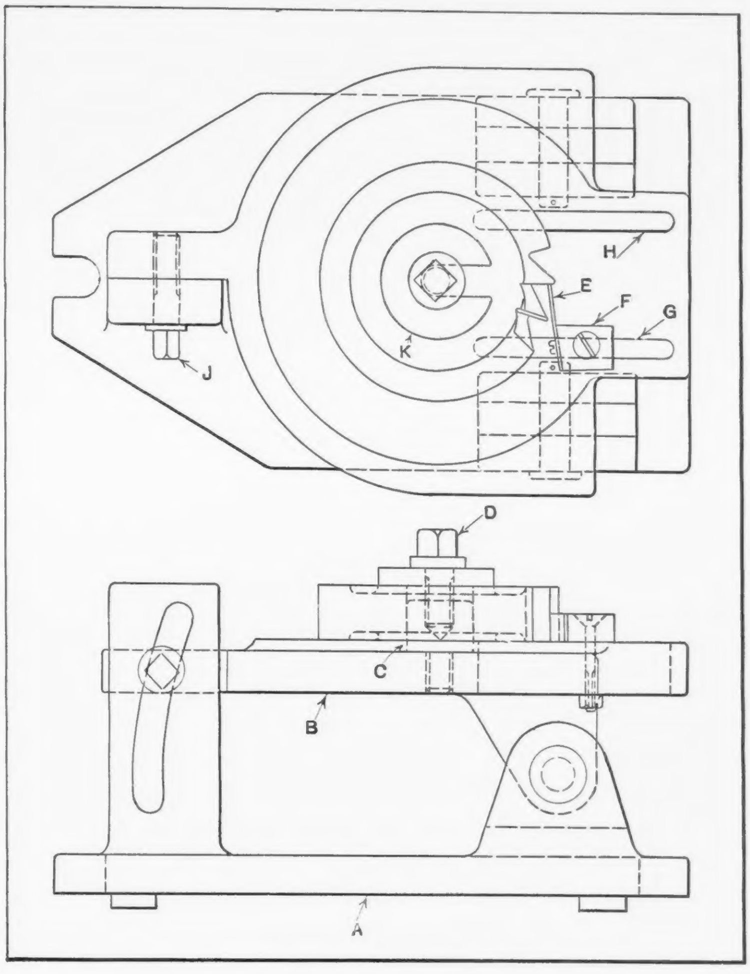
The next operation is performed on a crank shaper equipped with a special fixture, as shown in Fig. 3. This fixture is designed to locate the back arm from the finish-bored hole and against the rough casting. The work is held in this position by a nut and washer for machining the upper surface and the slot. The bottom surface and slot are machined with the work clamped in a fixture such as shown in Fig. 4. The next operation consists of drilling the holes in the top surface of the arm on a drilling machine, with the work held as shown in Fig. 5. The bottom end of the arm is drilled with the work held in a similar manner, as shown in Fig. 6.

* * *

Fixture for Milling Tooth Clearance on Cutters

By THOMAS M. GARRY

A fixture for milling the tooth clearance on the sides of side milling cutters is shown in the accompanying illustration. This fixture was not designed to meet the demands of high production, but is well adapted for tool-room use; it may be used for milling not only a wide range of side milling cutters, but angular cutters as well.



Fixture of Interchangeable Design for Milling Tooth Clearance on Various Sizes of Side Milling and Angular Cutters

It consists primarily of the base *A* and the work-holding plate *B*. The base is bolted to the table of the machine, and plate *B* can be swiveled on it to locate the work at the correct angle, so that after milling, the edges of the tooth lands will be parallel. Plate *B* is secured in the different angular positions by the clamping screw *J*. The work is centered on the interchangeable plug *C*, secured in the plate, and is fastened in position by means of the screw *D*.

The method of indexing the cutter for milling the different teeth is similar to that employed in sharpening the teeth of cutters. Each tooth is located by the spring finger-stop *E*, which is fastened to a sliding block *F*. This block can be adjusted in the slot *G* for cutters of different diameters.

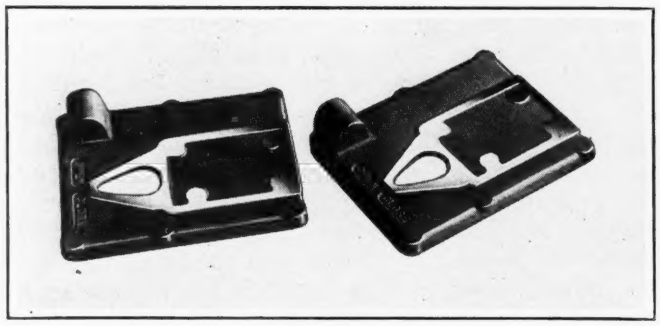
After the work has been centered over the plug *C*, it is swung in a clockwise direction until the face of the tooth to be milled comes against the end of the finger-stop, after which the work is clamped in position. Each successive tooth is milled in this manner. To mill the opposite side, the cutter is reversed on the plate. For this operation, the finger-stop is transferred to the slot *H* and the same procedure is followed.

If a C-washer such as shown at *K* is used, the screw *D* need not be removed from the fixture when loading or unloading the work, as the flange of the screw is small enough to pass through the hole in the cutter.

* * *

The real difficulty with our business conditions is that no one has yet been able to propose a generally acceptable economic system that makes it possible for the people of the United States to acquire and make use of all that they are able to produce. The solution of this problem would eliminate periodic depressions and unemployment. The trouble is due not to over-production, but to under-consumption.

Grinding Flat Thin Work



Difficulties Experienced with this Kind of Work Have Been Met by Ingeniously Designed Equipment

THE production of true flat surfaces on thin work often presents difficulties. To overcome the trouble experienced with this class of work, the methods illustrated and described in this article were devised and have been employed with very satisfactory results on a Blanchard vertical surface grinder.

The flat pieces shown in the heading illustration have a boss or lug that projects above the surface to be ground. By arranging the parts on the magnetic chuck of the surface grinder as shown in Fig. 1, the surfaces can be ground without any interference from the projecting portions. In this case, the pieces are so located that the projections are positioned toward the center of the chuck. The table is run only part way under the grinding wheel, so that the projections clear the wheel.

The vertical surface grinder shown in Fig. 2, equipped with a magnetic chuck, is employed for grinding both sides of thin iron castings that serve as card-holders. The surfaces on these castings are large and must be ground parallel. Difficulty would be experienced in finishing these parts by any other method, owing to the tendency of the pieces to deflect when subjected to pressure. These parts are located on the magnetic chuck as shown without any special holding devices. The finished sides are ground from the rough. The pieces are 5 3/4 by 7 1/2 by 3/4 inch in size, and are required to be machined within limits of + 0.002 and − 0.000 inch. About 0.050 inch of stock is removed from each side at the rate of ten pieces, or twenty surfaces, per hour.

In Fig. 3 is shown a vertical surface grinder with a plain table instead of a magnetic chuck. This machine is equipped for grinding clutch facings, which are fed by a magazine into pockets on the table formed by cleats having serrated edges. The serrated edges on the cleats, as indicated at *A*, prevent the facings from spinning or turning around while being ground. Presser feet, as shown at *B* and *C*, hold the facings on the table under spring tension. This feature provides for holding facings of different thicknesses. As the wear on the wheel is very slight, no automatic down feed is necessary, the wheel setting simply being adjusted for size occasionally by means of the handwheel.

In the illustration, the wheel is shown raised from the grinding position. For grinding, the cylinder wheel is lowered into position over the cleats *C*, which project upward into the clearance space within the rim of the grinding wheel. After passing under the grinding wheel, the pieces are automatically ejected. In operation, the wheel is enclosed by dust guards, and a blower system is provided to carry away the waste, the grinding being done dry. The 10-inch size clutch facings illustrated are machined at the rate of 1200 pieces, or 2400 surfaces,

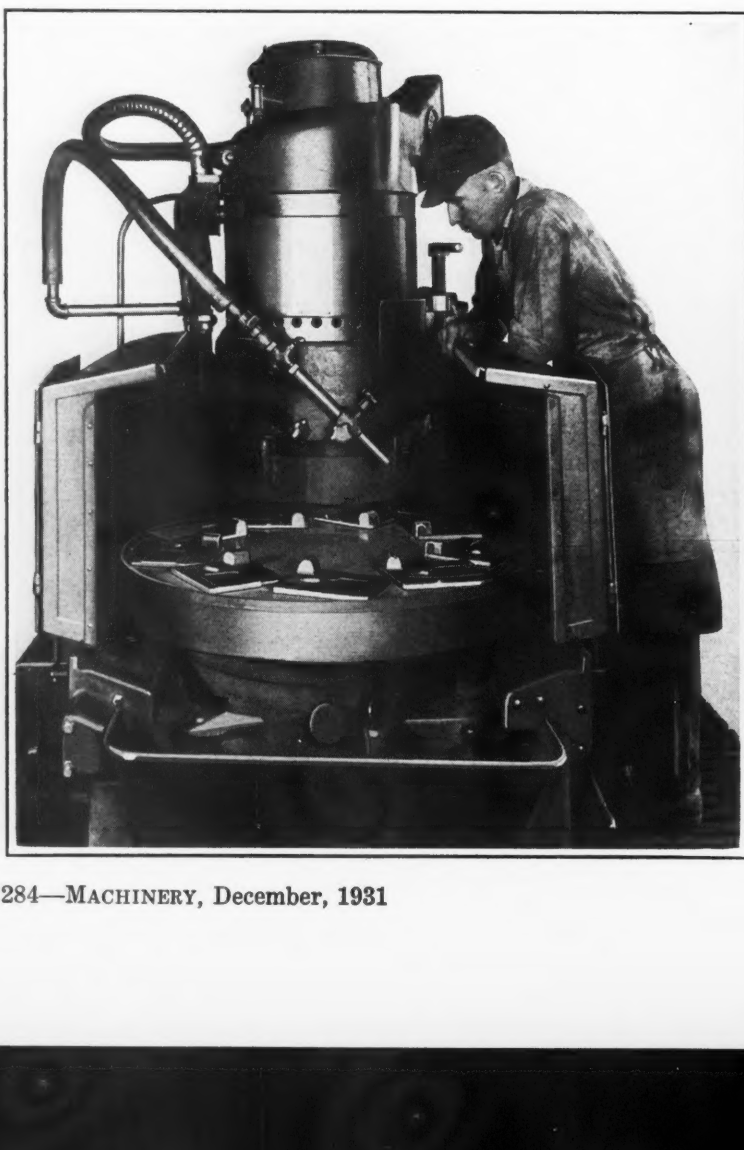


Fig. 1. Surface-grinding Flat Castings that Have a Projecting Boss

per hour, about 0.010 inch of stock being removed per side. The work is held within limits of ± 0.0015 inch.

Three types of grinding are required to produce the saws shown in Fig. 4. The saw at the left is ground flat, while the one in the middle is ground concave over its whole surface. The saw at the right is ground concave up to the hub or collar. Four operations are required in grinding the concave saw shown in the middle view. First, the saw is ground flat on two sides, then the spindle is tipped forward by an adjustment of the three-point column support and the two sides are ground concave.

In grinding the saw shown at the right, the table is so positioned under the wheel that the edge of the grinding wheel forms the outside of the collar. The concave 14-inch rip saw shown in the middle is ground at the rate of eight pieces, or sixteen surfaces, per hour. The 20-inch saw at the right is ground at the rate of three pieces per hour.

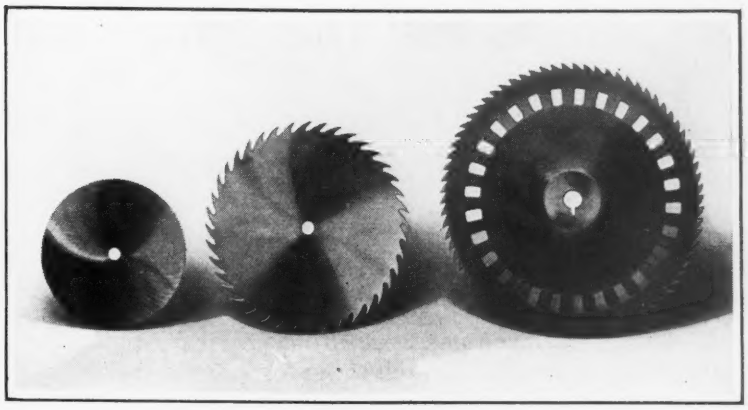


Fig. 4. Examples of Circular Saws Ground to Required Thickness on Blanchard Surface Grinder

* * *

Long Terms of Uninterrupted Service

The Chicago Pneumatic Quarter Century Association was recently formed to include all employes of the Chicago Pneumatic Tool Co., of New York City, who have completed twenty-five years or more of uninterrupted service. Seventy-five men and women were eligible for membership. An engraved certificate of membership and a specially designed solid gold pin were presented to each member. Louis H. Brueggemann, now employed at the Detroit, Mich., plant, has the longest record of any of the company's employes in the United States. He has been with the company since April, 1898. Horace P. Marshall, manager of the Leeds, England, office, has, however a longer record among those in the company's employ abroad, having been with the company since April, 1896. Among the women, Miss Florence Aldcorn of the New York sales office holds the record, having been with the company since March, 1900.

Fig. 2. Grinding Thin Fragile Castings Held Directly on Magnetic Chucks

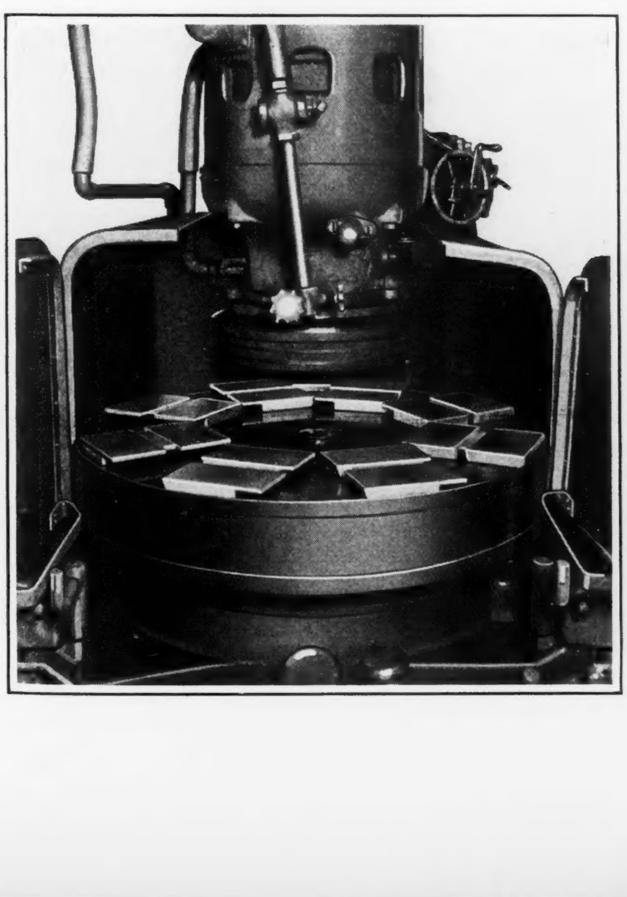


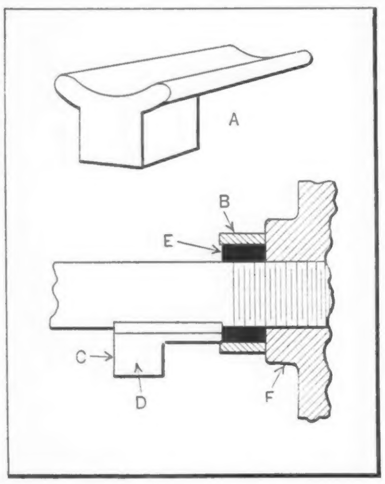
Fig. 3. Grinder with Magazine for Feeding Clutch Facings to Non-magnetic Table

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Making Pipe Joints Tight with "Smooth-On"

In setting up machines, it is often necessary to make pipe connections for air, water, or steam. As leakage of the pipe connections or fittings may cause considerable damage or even prove dangerous, it is important that the joints be carefully made. The old method of using red lead to obtain a tight joint cannot be depended upon to prevent leakage, as the vibration of the machine will sometimes loosen the red lead.



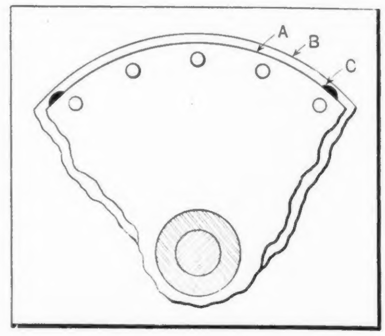
Method Used to Make Pipe Joint Tight

A better method and one that has been used by the writer for some years is described here. Referring to the illustration, a strap or clamp *B* of ordinary sheet metal is placed around the pipe close to the flange *F* on the machine, the same procedure being followed in the case of pipe fittings such as couplings and unions. There should be a clearance between the pipe and strap of about 1/8 inch. This space is packed with No. 3 "Smooth-On" mixed with water to about the consistency of putty. A putty knife is used in applying the mixture, which is then tamped firmly in place with a tool made as shown at *A*. This tool is gripped at *D* while the end *C* is tapped gently with a hammer. After the space between the pipe and the strap is well filled, the clamp *B* is tightened up as much as possible. The mixture will harden in about an hour, after which the piping is ready for use.

Boston, Mass. CHARLES R. WHITEHOUSE

Auxiliary Index-Plate for Obtaining Special Number of Divisions

In some dividing heads the number of divisions into which the work can be divided is limited. In order to use a head of this type for indexing work to a number of divisions outside the range of the standard index-plate, the writer used an auxiliary plate as indicated at *A* in the illustration.



Auxiliary Index-plate Soldered to Standard Plate to Obtain Special Number of Divisions

This plate is about 1/64 inch thick and has a number of equally spaced holes drilled in it, for obtaining the desired number of divisions. It is secured to the regular index-plate *B* by solder at various points along its periphery, as at *C*.

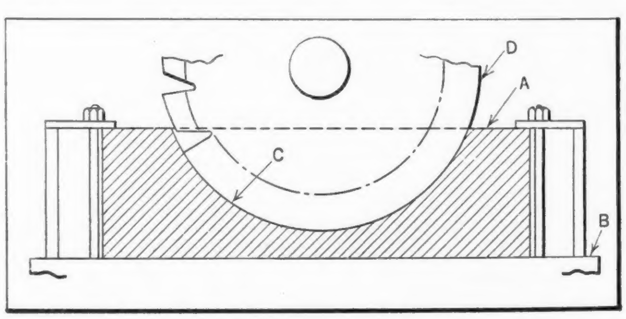
As the holes in the auxiliary plate are very shallow, the end of the indexing plunger must be made square, so as to fit securely in the holes. When this plate is no longer needed, it can be quickly removed from the standard plate by touching a hot soldering iron to the soldered points.

Victoria, Australia C. J. DROLZ

Milling a Spherical Depression

Concave surfaces of spherical shape, such as are found in dies, molds, etc., can be readily milled on a standard milling machine without employing special equipment other than a power-driven circular milling attachment and a milling cutter of the proper contour. As indicated in the illustration, the work *A* is clamped in such a position on the circular table *B* that a vertical line passing through the center of the depression *C* will also pass through the center of the convex cutter *D*.

In milling, the machine table is fed upward by hand until the cutter has entered the work to nearly the full tooth depth. The rotary feed of the table is then engaged, and the table is allowed to rotate one revolution, after which the rotary feed is stopped. The table is now raised again for a sec-



Milling a Spherical Depression as the Work Rotates on a Circular Milling Attachment

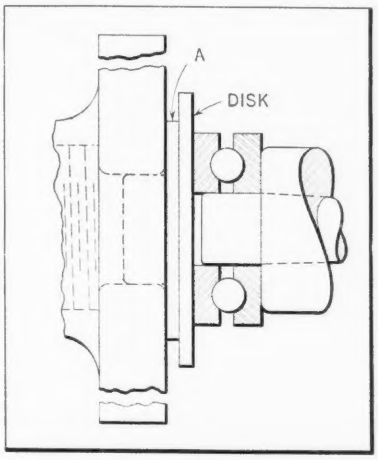
ond cut, and the rotary feed engaged. The number of cuts required depends upon the depth of the depression.

Obviously the diameter of the cutter chosen must be the same as that of the spherical depression. Either a convex cutter, a double-angle cutter, or a fly cutter of the double-angle type can be used. For roughing out the depression, a side milling cutter can be employed, after which one of the other type cutters can be used for the finishing cut.

Dayton, Ohio F. J. WILHELM

Method of Turning a Thin Disk

A method employed in one shop for turning plain disks to an accurate diameter is shown in the accompanying illustration. The round steel pad *A* is placed against the lathe faceplate, and next to this is placed the rough disk. This disk was previously cut on the lathe faceplate from a square piece of flat stock. To hold the disk while it is being turned, a ball thrust bearing, centered on a plug in the tailstock spindle, is provided.



Method of Holding Thin Disk while Turning

The tailstock spindle is fed out until the pressure between the bearing and the disk is sufficient to prevent the disk from slipping under the action of the cutting tool. By inserting the pad between the disk and the faceplate, enough clearance is provided to allow the cutting tool to pass the inner edge of the disk.

Stamford, Conn. JOSEPH E. ABBAZIA

Using Castor Oil for Tapping

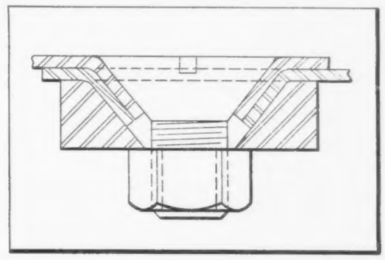
Castor oil is a fine lubricant for tapping small fine threads. It may be thought that it is too costly to use for this purpose, but the writer has found, by an actual study, that because of the small amount of oil needed for lubricating the tap, its cost for a given production is not greater than that of lard oil. In fact, in one test it was 15 per cent less.

Castor oil is also useful for drilling with very small drills. To lubricate either a tap or a drill, dip a brush in the oil, wipe it against the side of the container, and then apply it directly to the tool. This provides sufficient oil to lubricate the tool the required amount.

Boston, Mass. CHARLES R. WHITEHOUSE

A Strong Lap Joint for Thin Plate

Frequently, comparatively thin plate is required to be lap-joined so that the bolts or rivets used for making the joints are flush on one side of the plates. Countersinking the plates in the usual way, to provide recesses for the screw or rivet heads, is impracticable in many cases because the resulting joint would be too weak to withstand ordinary stresses; moreover, the extra large clearance holes would allow the plates to shift one upon the other while in use.


Method of Obtaining a Strong Lap Joint with Screw Heads Flush on One Side

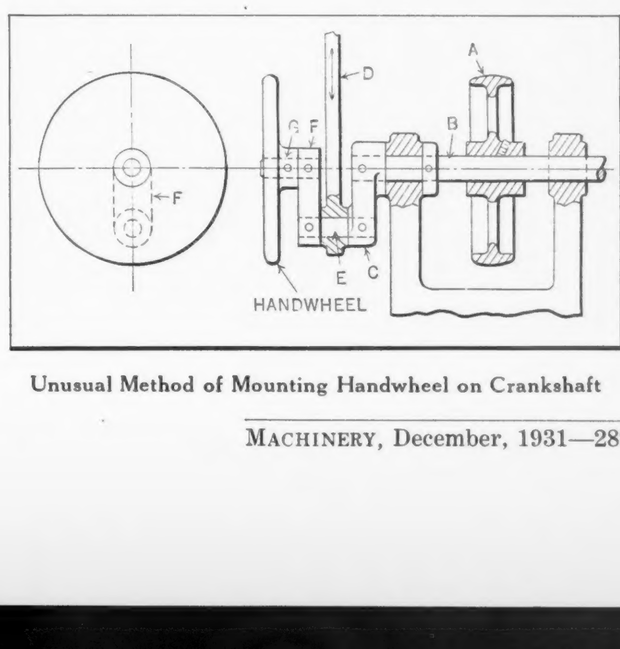
One way of meeting the requirements is to form conical depressions in the mating plates as shown in the illustration. These depressions may be formed by a simple punch and die—either hand or power-operated. In the joint shown, a flat-head screw is used for fastening, and as the nut is tightened, sufficient pressure is transmitted to the countersunk washer to insure an unusually tight joint. With this arrangement, it is impossible for the plates to shift.

Toronto, Ont., Canada CLIFFORD CORNWALL

Kink for Attaching Handwheel to Crankpin

After constructing a power-driven machine, it was found desirable to provide means for turning the machine over by hand. This was done by mounting a handwheel at the end of the driving shaft in rather an unusual manner.

Referring to the illustration, the pulley *A* drives shaft *B*, causing crank *C* to revolve and impart an up and down motion to the connecting-rod *D*. The original crankpin, which had a short head designed to keep the crank in position, was replaced by the pin *E* and the block *F*. The distance between the holes for pins *E* and *G* in block *F* is equal to the throw of the crankpin. Thus the handwheel, when mounted on pin *G*, revolves in a circle about shaft *B* as a center. H. M.



Unusual Method of Mounting Handwheel on Crankshaft

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

J. C. D.—The writer has heard the term "spill-boring" used with reference to the finishing of very accurate bores in rifle barrels, and would like to know something about this method.

A—The following quotation from an article in the September *American Rifleman*, by Major J. S. Hatcher, answers this question quite concisely: "In making these barrels, the Vickers people use a method of finish-boring known as 'spill-boring,' in which the cutter has several teeth, with the first tooth sharpened and adjusted to take an exceedingly fine cut, the other teeth being rounded over so as not to cut at all, but to burnish the metal instead. This method of boring gives the smoothest possible finish, and is said to harden the surface of the metal so as to make it wear longer." The "Vickers people" referred to in the quotation are the British firm of Vickers, Ltd., and the barrels mentioned are for the Vickers small-bore target rifles, such as are used in accurate match shooting at small-bore ranges.

Worm-Gearing Designed for Given Center Distance

H. L. M.—In the design of worm-gearing, if it is necessary or at least desirable to maintain a certain center-to-center distance between the axes of the worm and worm-wheel, either to permit using the gearing in connection with certain other machine members or to design a drive that is as compact as is consistent with strength requirements, what is the general procedure?

A.—In designing with reference to the center distance, the problem may be to determine what pitch would be obtained with gearing of a given ratio and center distance. Suppose, for example, that the desired center distance C is 6 inches and the ratio 6 to 1. As a trial combination, assume that the worm is to have 5 threads (quintuple-threaded) and the wheel 30 teeth.

If C = distance between centers of worm and worm-gear;
P = pitch of worm and circular pitch of worm-gear;
N = number of teeth in worm-gear;
n = number of threads on worm, that is, whether double-, triple-, or quadruple-threaded, etc.; and
β = helix or lead angle of worm as measured from a plane perpendicular to the axis; then

$$C = \frac{P}{2 \times 3.1416}\left(\frac{n}{\tan\beta} + N\right) = 6 \text{ inches}$$

As $n = 5$ and $N = 30$,

$$\frac{5P}{\tan\beta} + 30P = 2 \times 3.1416 \times 6 = 37.6992$$

Assume that the lead angle β is to be 35 degrees; then

$$\frac{5P}{0.70021} + 30P = 37.6992, \text{ and} \left(\frac{5}{0.70021} + 30\right)P = 37.6992; \text{ hence } 37.14P = 37.6992 \text{ and } P = 37.6992 \div 37.14 = 1.015$$

Since the worm-wheel is to have 30 teeth, its pitch diameter D is:

$$D = \frac{30 \times 1.015}{3.1416} = 9.693 \text{ inches}$$

The pitch diameter of the worm $d = \dfrac{l \times \cot\beta}{3.1416} = \dfrac{n \times P \times \cot\beta}{3.1416}$

Hence

$$d = \frac{5 \times 1.015 \times 1.4281}{3.1416} = 2.307 \text{ inches}$$

and

$$C = \frac{9.693 + 2.307}{2} = 6 \text{ inches}$$

In actual practice, the pitch P of 1.015, which represents the axial pitch of the worm and the circular pitch of the worm-wheel, might be reduced to exactly 1 inch, thus reducing the center distance somewhat in order to avoid the fractional dimension. As the lead angle of the gearing in the foregoing example is 35 degrees, the tooth proportions should be based upon the normal circular pitch, which, in this instance, equals 1 × cos 35 degrees = 0.819 inch.

The trial combination selected for this 6-inch center distance might be varied in order to change the pitch of the teeth, either to meet the power-transmitting requirements of the gearing or to permit the use of some existing hob.

* * *

The danger attending the pouring of molten lead into a cavity without making sure that the hole is perfectly dry should be emphasized. The pouring of hot lead into a hole in a cement floor, for example, in order to fill the opening around a pipe, has been the cause of serious accidents. If there is water at the bottom of the hole, the molten lead is likely to be thrown out of the hole with tremendous force, severely burning the man doing the work.

Hand-Miller Fixture with Automatic Clamping Arrangement

By WILLIAM P. GALLAGHER

A RAPID and simple means of clamping small parts is provided in the fixture shown in Figs. 1 and 2, which was designed for use on a hand miller. The work is automatically clamped through the action of a cam. This fixture may be adapted to nearly any part ordinarily milled on this machine. For different parts, it is only necessary to make special locating plates; but if the parts differ greatly in size and shape, a special knockout plunger may also be required. In a few rare cases, special clamping fingers may be found necessary.

Referring to Fig. 1, the work is automatically clamped on the forward movement of the table by means of the clamping finger *B*, which is operated by a cam *E* mounted on the machine column. The clamping finger is keyed to one end of the shaft *C*. At the other end of this shaft is pinned the lever *D*, on the free end of which is mounted a ball bearing. This bearing serves as a roller and engages the groove in the cam *E*.

As cam *E* is stationary, a forward movement of the fixture causes finger *B* to swing downward and clamp the work just before the cutter comes into action. The work remains clamped while the cut is being taken, but upon the return of the table to the loading position, the movements of the mechanism take place in the reverse order, swinging the clamping finger far enough to the right to permit plunger *A* to eject the work. As the work is ejected, it drops into the chute *G*, Fig. 2. The coil spring between the knob on plunger *A*, Fig. 1, and the fixture normally holds the plunger clear of the work.

Variation in the thickness of the parts is compensated for by the springing of the lever *D*. To facilitate the springing action, this lever is made of tempered spring steel, S A E special 6145. The cross-section is of such a size as to permit a deflection of approximately 1/4 inch under a load of 800 pounds applied at the center line of the roller. In making this part, care was taken to see that all tool marks were removed from the lever before heat-treating, to prevent fracturing while in use.

The clamping pressure may be increased by moving the cam *E* downward on the machine column. To prevent excessive wear of the cam groove at the clamping points, the upper part of the groove is lined with a piece of hardened tool steel.

Serrations on the face of the clamping finger *B* serve to force the work down against the work-stops, thus insuring a uniform depth for the milling cut. The work-holding plate *F* is made of tool steel, hardened and ground.

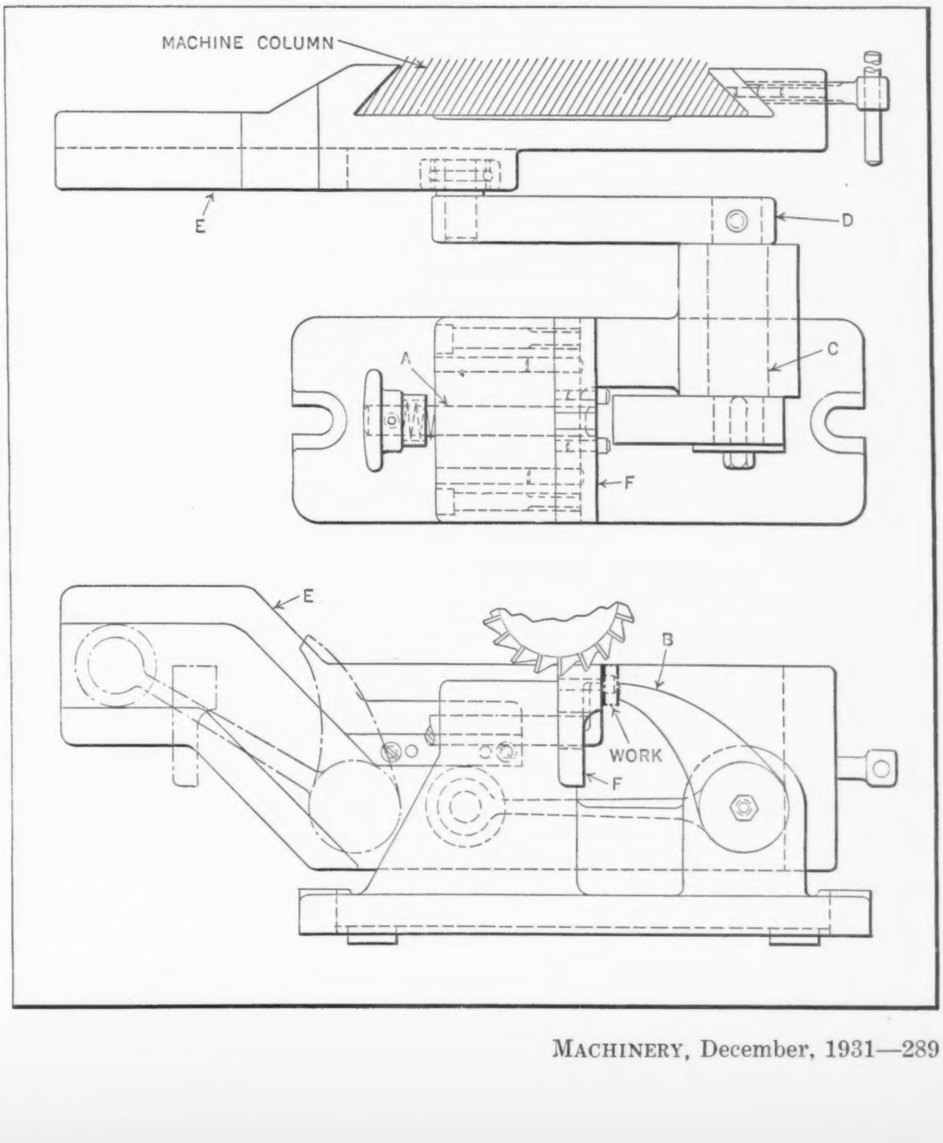


Fig. 1. Hand-miller Fixture in which the Work is Automatically Clamped by a Cam on the Machine Column

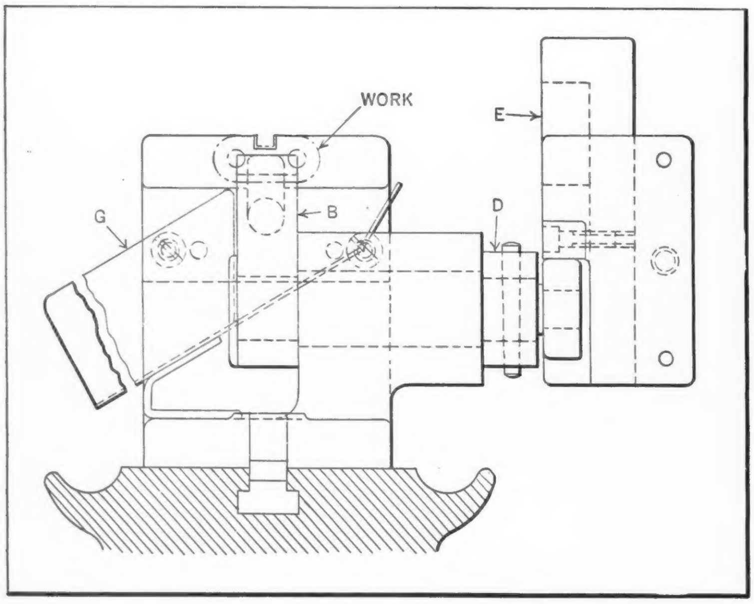


Fig. 2. End View of the Fixture Illustrated in Fig. 1, Showing the Work in its Clamped Position

If a large number of different parts are to be milled and special work-plates are needed, it is advisable to make a drilling templet for locating the screw and dowel holes. In milling thin sheet-metal parts, the work-holding plate should support the part to within one hundredth of an inch of the finished milled surface.

* * *

Developing a New Formula for the Strength of Springs

The following item, of interest to all spring designers, is quoted from "Stories of Westinghouse Research," published by the Westinghouse Electric & Mfg. Co.:

"For some time, engineers noticed that heavy, closely coiled, helical springs (like those on railway trucks) frequently broke under loads which the universally accepted formulas said were within their strength. Generally, the blame was laid to careless heat-treatment. A. M. Wahl, however, became suspicious of the accepted formulas. Working from the ground up, he made a mathematical analysis of stress distribution in large helical springs, and found that the actual shearing stress was from 40 to 60 per cent greater than given by the accepted formula, and that stress piled up on the inside surface of the spring to 240 per cent of that on the outside.

"The new formula was checked by testing helical springs under actual load conditions. Measurements were also taken by extensometers. Visual proof supported the theoretical results in every detail. This investigation of helical springs is an excellent example of the contrast between the traditional faith of engineering in handed-down formulas and the challenging attitude of the research worker."

Specialization in Lubricants

The importance of lubrication is becoming more and more recognized. In the past, one lubricant was frequently used for practically all purposes in a shop. Today, there is a great deal of specialization in lubricants; and to obtain the best results, the user should take advantage of the research that has been made by several of the concerns selling lubricants.

Many users of lubricants have also engaged in extensive research work. The Otis Elevator Co., for example, has found that twenty-nine different kinds of lubricants are required to operate various types of elevators properly. The oil used in the lubrication of the worm-gear of an elevator is considered by the company as one of the most important; a lubricant must be selected that will assure a permanent oil film between the gear teeth and the worm. Another lubricant that requires great care in selecting is the one used in the door checks in elevators having doors that open and close automatically. This oil must have sufficient body to act as a buffer; it must be non-corrosive; and it must not evaporate appreciably or be sensitive to changes in temperature.

* * *

Formulas for Weights of Bar Stock per Foot

By L. F. SWENSON

The weight per lineal foot of steel bar stock of various shapes can be found quickly by applying the following formulas, which give results that correspond closely with the values in MACHINERY'S HANDBOOK.

For *round steel bars*, the weight per lineal foot equals $\frac{(4d)^2}{6}$, where d is the diameter, in inches.

For *square steel bars*, the formula is $\frac{(4d)^2}{4.7}$, where d is the length of each side.

The formula for *hexagon steel* is $\frac{(4d)^2}{5.45}$, where d is the distance across flats.

For *flat steel*, the formula is $\frac{4t \times 4w}{4.7}$, where t is the thickness and w is the width.

It should be noted that the expression "$4d$" equals the number of "fourths" in dimension d. This may help one to remember the formulas.

* * *

A good executive is not necessarily a good craftsman, any more than a good craftsman is necessarily a good executive.—*The Shop Review*

Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen

Pneumatic Banding Machines for Locomotive Springs

By H. H. HENSON, Foreman, Machine and Erecting Shops, Southern Railway Co.

Assembling the plates of large semi-elliptical springs for locomotives is an exceedingly laborious job when performed in the blacksmith shop without the aid of special equipment such as shown in Figs. 1 and 2. The machine shown in Fig. 1 is used to compress the plates *S* of locomotive driving- and trailing-truck springs, so that the hot steel band *R* can be placed in position. This machine is employed as an auxiliary to the banding machine shown in Fig. 2, which applies tremendous pressure to all four sides of the hot band assembled on the spring plates.

Spring bands applied in this way will not become loose or permit the leaves of the spring to work loose in the band. The Interstate Commerce Commission has stringent rules covering defective locomotive driving-wheel springs, and the machine shown in Fig. 2 has made it much easier to meet these requirements. In fact, the banding machine is credited with having reduced the number of defects found in locomotive spring assemblies by about 50 per cent.

In operating the machine shown in Fig. 1, the spring leaves or plates are placed on top of the frame *F* in a horizontal position. Air is then admitted to the cylinder *A* through a four-way air valve. This causes the piston *C* to clamp the leaves of the spring together in the proper position to receive a C-clamp. After the C-clamp is fastened, the spring is revolved, so that it is in the vertical position shown in Fig. 1. The assembling machine has a slotted portion in the frame which permits this pivoting or revolving movement.

The hot steel band *R* is next applied to the spring in the proper position to receive the banding or shrinking pressure. The spring is now released from the assembling machine and pushed along the table *T* to the banding machine, Fig. 2, for the final operation. When the band on the spring is located properly in the opening *P*, air is admitted to the cylinders *B* by manipulating the levers of two

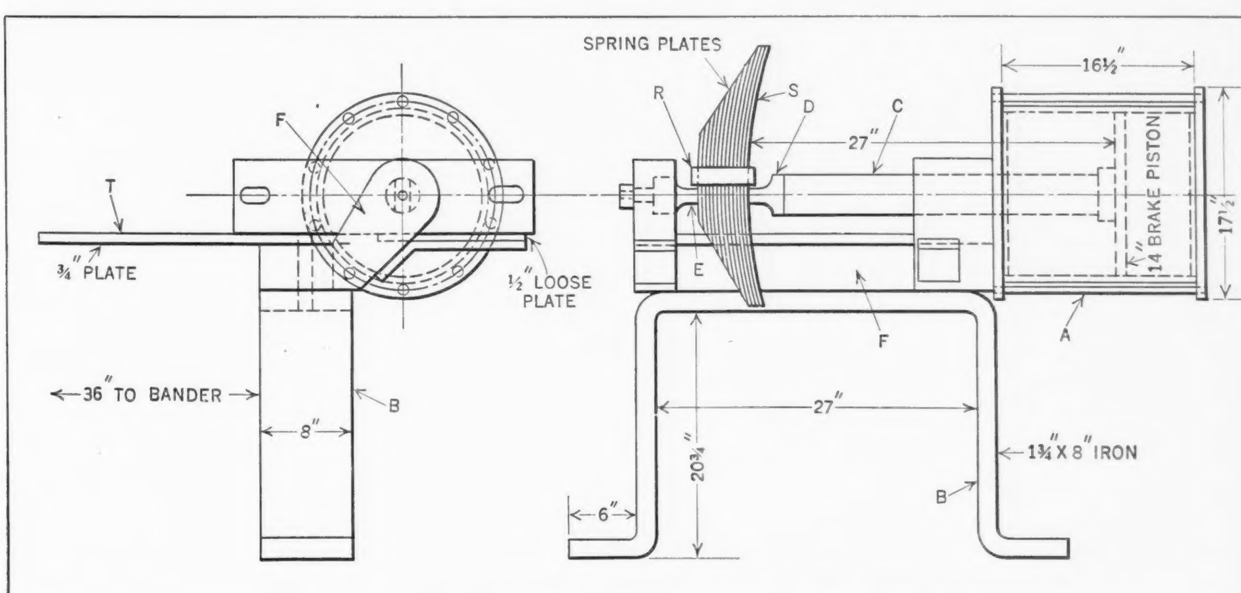


Fig. 1. Machine for Pressing together the Plates S of a Locomotive Spring to Permit Placing the Hot Steel Band R in Position

three-way valves. This causes the pistons *K* and *F* to advance and force the blocks *J* against the band. The arrangement of the pistons at right angles to each other results in pressure being applied to all four sides of the band. The total pressure applied in this manner is about 72 tons. After completing this operation, the band is cooled by a stream of water from a conveniently located hose.

Although the machine illustrated in Fig. 2 can be used without the assembling machine shown in Fig. 1, it is essential, from a production standpoint, that the latter machine be employed. The auxiliary machine should be placed about 5 feet from the banding machine and connected to it by the steel plate *T* which is 30 inches wide by 3/4 inch thick. The assembling machine, Fig. 1, is made up of about five members, namely, a 14- by 12-inch air cylinder *A*, a steel frame *B*, a four-way air valve (not shown), a piston-rod *C* with a ball-bearing center *D*, and a ball-bearing tail-center *E*, details of which are shown in Fig. 3.

Practically all the dimensions required in building a banding machine like the one shown in Fig. 2 are given in the assembly and detail views of this illustration. The air cylinders *B*, which actuate plungers *K* and *F*, have a diameter of 18 inches and a stroke of 12 inches. The pistons of the air cylinders are connected to the ends of the levers *C* by jaws *L*. The opposite ends of levers *C* are pivoted on the shanks of the plungers *K* and *F*. The levers *C* fulcrum on 2 1/2-inch tool-steel pins in the links *D* and *E* at points *M*.

The piston-rods are of carbon steel, and are 2 1/2 inches in diameter. The base *N* of the machine is made of channel iron, 3/4 inch thick by 18 inches wide by 6 feet long. The frame *A* is a steel forging or it can be made of cast steel 5 inches thick by 2 feet 11 inches high by 4 feet long. The frame is

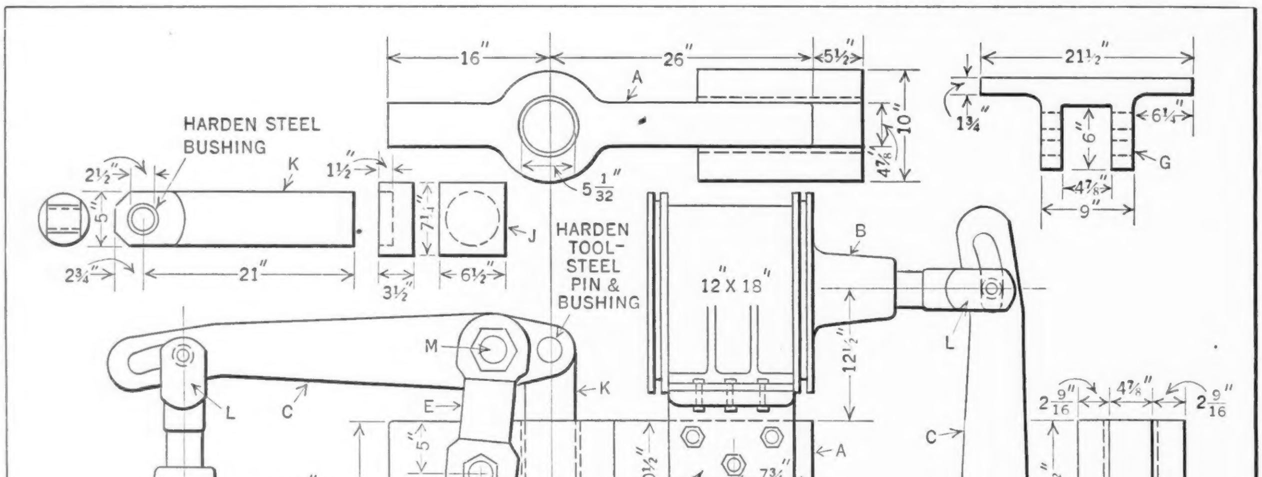


Fig. 2. Machine with Two Powerful Pneumatically Operated Plungers for Subjecting Four Sides of Locomotive Spring Band to High Pressure

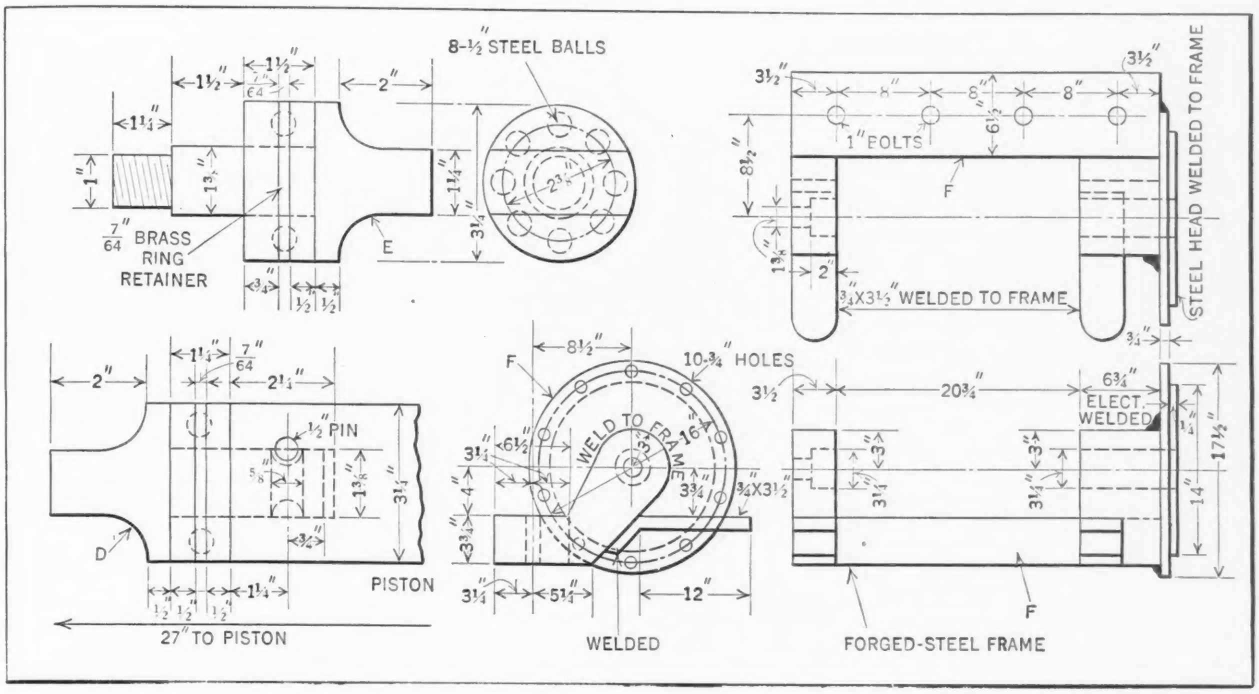


Fig. 3. Details of Parts for Machine Shown in Fig. 1 (Parts D and E Shown to Larger Scale than Part F)

fastened to the base *N* by 7/8-inch steel rivets and the angle-irons *O*, which are 3/4 by 4 by 54 inches. The slot or work-opening *P* in the forging *A* is 15 inches high by 20 inches long. This opening is large enough to accommodate any of the driving springs, some of which are made up of nineteen plates 1/2 inch thick, 6 inches wide, and 52 inches long. The two tool-steel plungers *K* and *F* are connected to the large levers *C*.

The two levers *C* are of the same length and thickness. The holes or bearings that support the plungers *K* and *F* in the forging *A* have bronze bushings, and the plungers are hardened and ground to a smooth finish. This construction prevents galling and binding while under the severe strain developed when the machine is in operation. The links are made of carbon steel and are forged and finished all over. The blocks *J* are hardened to prevent deformation.

* * *

Cigarette Taxes and Electric Welders

We said last month that it was a far cry from printing press manufacturing to the making of airplanes, but it seems to be even farther from cigarette taxes to electric welding machines. Yet the cigarette taxes imposed by several of the states have favorably affected the demand for welding machines.

As a result of the cigarette tax, an Ohio tobacco manufacturer developed an ingenious device for "rolling your own." So large has been the demand for these cigarette rolling devices that the Federal Machine & Welder Co., Warren, Ohio, has sold nineteen automatic junior spot welders for use in manufacturing these cigarette rolling devices.

The Selection of Tracing Cloth and Blueprint Paper

By JOSEPH BELL

Blueprints rather than drawings are the ultimate product of the drafting-room. Drawings of good appearance do no always produce good blueprints, especially when the prints are made directly from pencil tracings, which is the customary practice.

The best tracing papers or pencil tracing cloths do not always make the best prints. It is therefore important to select tracing paper and cloth carefully with respect to the resulting blueprint. Furthermore, the coatings used on the blueprint paper itself should be selected with respect to the tracing paper or cloth used. This requires expert knowledge, and can best be done by calling in a representative of the blueprint paper manufacturer or dealer and having him try out different blueprint papers with the shop's tracings and blueprinting machine. The speed of the blueprinting machine is also of importance, and must be determined by experiment with relation to the tracings and blueprint paper.

While this appears to be a rather elaborate procedure, it need be done but once for its value to be realized. Anyone who has bought tracing paper in a haphazard fashion will find the improvement in the quality of the blueprints resulting from this practice to be quite remarkable.

* * *

America's present capacity for the production of goods, great as it is, is no greater than the people's willingness to consume. The real problem is how to give the consumer a chance to consume.

Three Battery Nuts per Second in One Machine

TO knurl, form, drill, face, and tap brass dry-battery nuts, such as shown at *A*, Fig. 1, at the rate of 180 per minute is admittedly fast work. To have all the nuts turned out at such high speed, completely finished, with good full threads and faces at right angles with the threads, is something hardly to be expected or hoped for. Nevertheless, these achievements are being realized with a five-spindle Davenport automatic (made by the Davenport Machine Tool Co., Inc., Rochester, N. Y.), equipped with tools such as shown in the accompanying illustrations. Similar tool arrangements are used to produce brass nuts of different types from round or hexagonal bar stock.

The operations performed at the five spindle positions are indicated in Figs. 1, 2, and 3 by the five views numbered 1 to 5. These operations are (1) center one nut, and knurl two nuts; (2) drill and counterbore one nut, and form two nuts; (3) grip one nut in the tapping chuck, cut off the nut, and tap it, the nut thus tapped being passed over the shank of the bent tap as indicated; (4) finish-drill and counterbore the second nut; (5) grip the second nut in the tapping chuck, cut off the nut, and tap the thread.

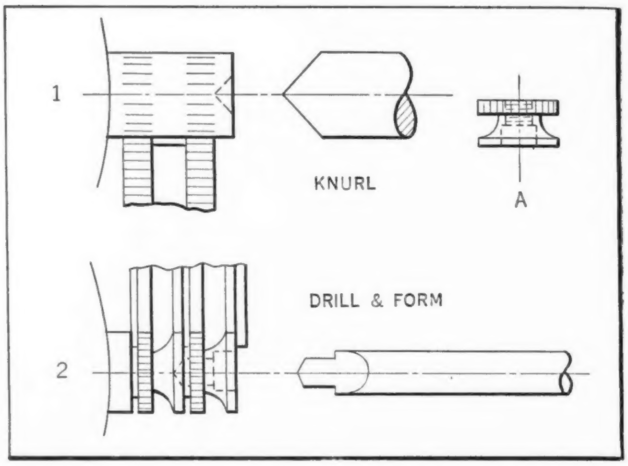
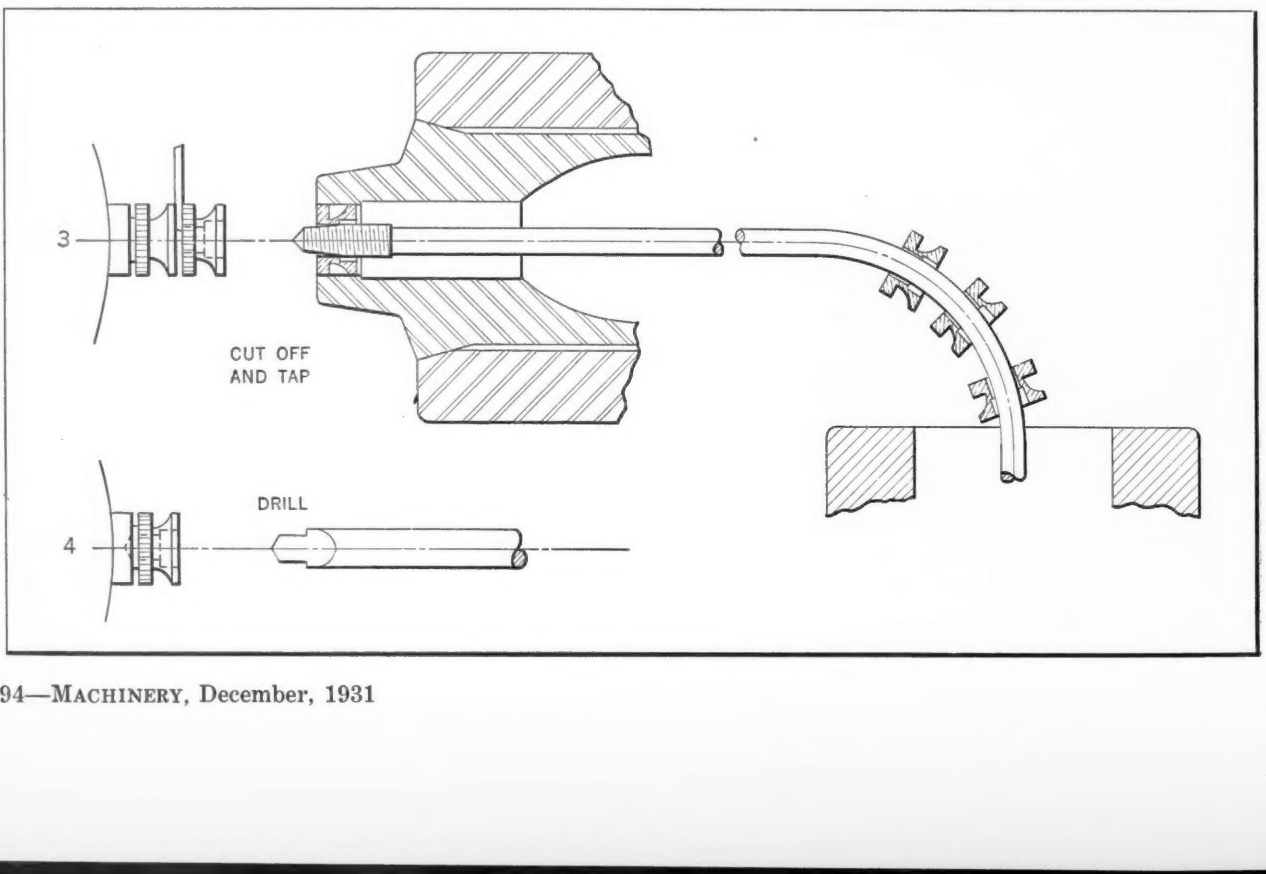


Fig. 1. Operations Performed on Battery Nuts in First Two Positions of Five-spindle Automatic

In tapping hexagonal nuts, a tooth clutch connection to the driving gear arrangement is used on the spindles, so that each work-spindle can be turned around until the hexagonal chuck in the work-spindle lines up with the hexagonal chuck in the burring or tapping spindle, after which the clutch is clamped securely. There are several advantages in making battery nuts with this type of attachment, as compared with the methods previously used. Squareness of the thread with the face of the nut is insured, because the tapping chuck has a positive grip on the nut before it is severed from the bar.

By employing bent taps, a longer lead section can be given the tap, making it possible to cut a much fuller thread than would be the case with an or-

Fig. 2. Third and Fourth Positions on Automatic, Showing Operations Following those Illustrated in Fig. 1



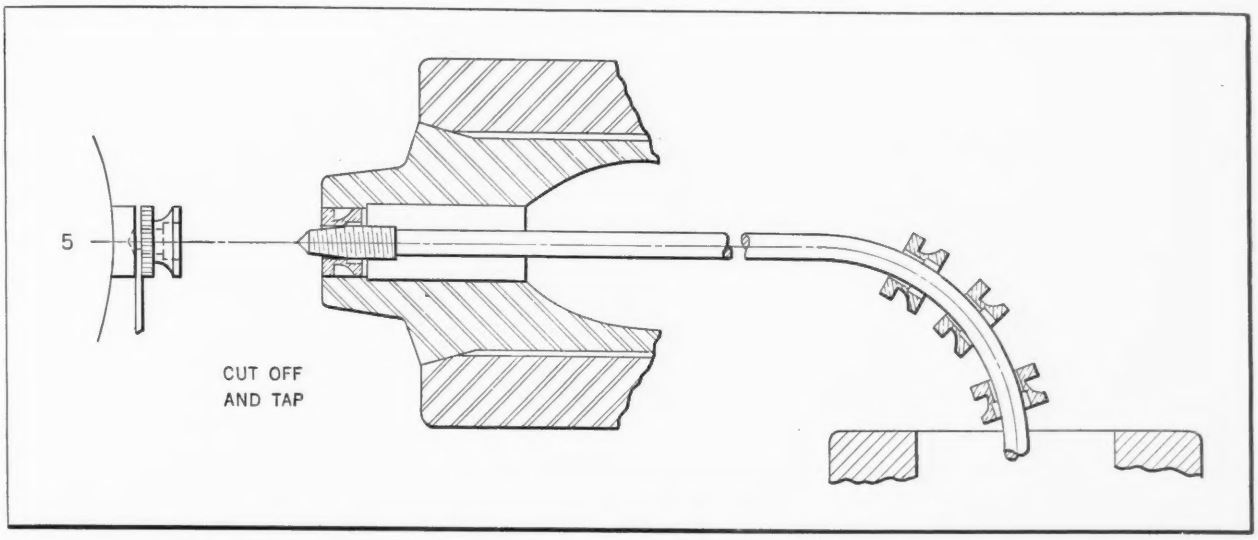


Fig. 3. Fifth Position on Automatic, where the Final Operation on the Battery Nut is Performed

dinary type of tap. This insures that all nuts that come off the end of the bent tap will have a full thread their entire length, whereas nuts that are tapped by the old method sometimes are not threaded all the way through, as is the case when the front part of the tap becomes chipped or broken.

Most of the parts used for the bent tapping attachment are from the regular burring spindle attachment and can be applied to any of the Davenport automatics. Besides being used for tapping nuts, this attachment can also be employed for supporting pieces of work that must be cut off without leaving the usual burr. In addition, it can be used for drilling shallow holes in the cut-off end or for countersinking a hole drilled through the work in a previous operation.

* * *

Manufacturers' Catalogues and Trade Literature Wanted in Russia

By CHARLES BUTTERWORTH

The writer, who previous to coming to Russia was for many years engaged as efficiency engineer in the forge division of a large automobile-building concern, is at the present time efficiency engineer with Orgametall and is engaged in planning methods and processes for the forge divisions of the new Soviet industries. This work includes planning the training of inexperienced men—from executives down to manual workers—in American mass-production methods. In this work it becomes necessary to instruct the men, in a most detailed manner, regarding the proper care and operation of machinery.

American manufacturers who have sold equipment to Russia, and those who are making efforts to sell in Russia in the future, could greatly help in the work of getting their machines better understood and more properly cared for, if they would supply more instruction literature pertaining to their machines than they have done in the past. There is a central library at the headquarters of Orgametall, but there is a comparatively small amount of catalogues and instruction books from American manufacturers in this library; while, on the other hand, the library seems to be well supplied with German literature. As a result, I believe that German equipment has been ordered when American equipment would have been more satisfactory for the purpose intended.

I receive many requests for information as to the most efficient machines for performing certain work and where they can be procured. A large percentage of the Russian engineers are now studying English, and trade literature placed in the hands of these men might aid considerably in furthering future sales. If manufacturers would care to send catalogues to me, care of Orgametall, Moscow, U. S. S. R., I would be glad to place them in the hands of engineers who could make use of them.

In my opinion, it will be a long time before Russia will be able to produce its own requirements in machine tools, and there is still an opportunity for tremendous sales over a period of years.

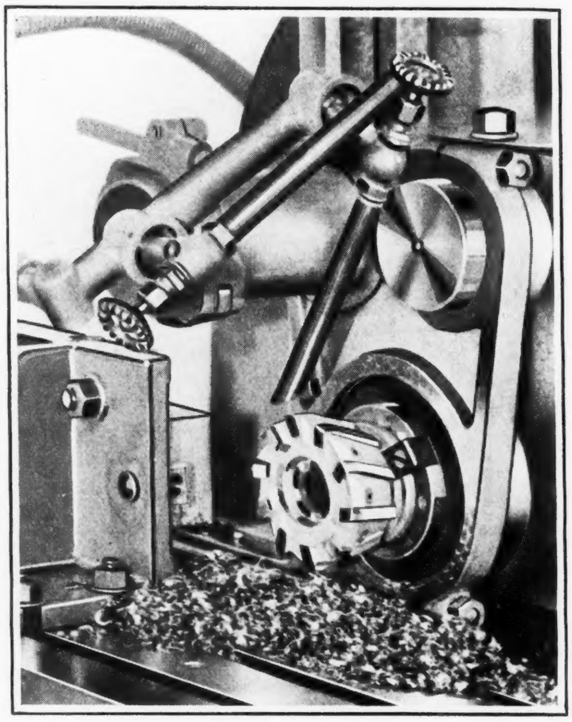
Orgametall is now opening branch offices in the principal cities in the Soviet Republics. It is from these branch offices that most requests for trade literature are received. It would aid considerably in re-establishing American machine tool sales in Russia if these outlying branch offices were supplied with information on available equipment.

During the past year I have been surprised to note the increase of German machine tools installed in the new plants, sometimes as much as 90 per cent of the machines in a department of a plant, as, for example, in the tool-room of the Rostov farm-implement shop, are of German make. In the large forge shop where there are 605 machines, 75 per cent are of German make. I know that many of them are not so efficient for the particular purpose for which they are used as American machines would be.

Cutting Steel with a New Cemented Carbide

Results of Tests Conducted on Widia-X to Determine its Capacity for Machining Steel

By ROGER D. PROSSER, Widia Department
Thomas Prosser & Son, New York



A NEW cemented-carbide cutting material intended specifically for machining steel has been produced by Fried. Krupp A.G., Essen, Germany, and is being placed on the American market by Thomas Prosser & Son, New York City. This hard alloy, which is known as Widia-X, is a mixture of several carbides held together by a binder. It contains a rare metal carbide not used heretofore. The manufacturing process is similar to that followed in making Widia cemented tungsten carbide. Thorough tests made in the Krupp laboratories have shown that, for machining steel, the new composition permits increases in cutting speeds as great as those that can be obtained with Widia tungsten carbide in cutting cast iron and non-ferrous metals. Widia-X does not supersede, but rather supplements existing grades of Widia.

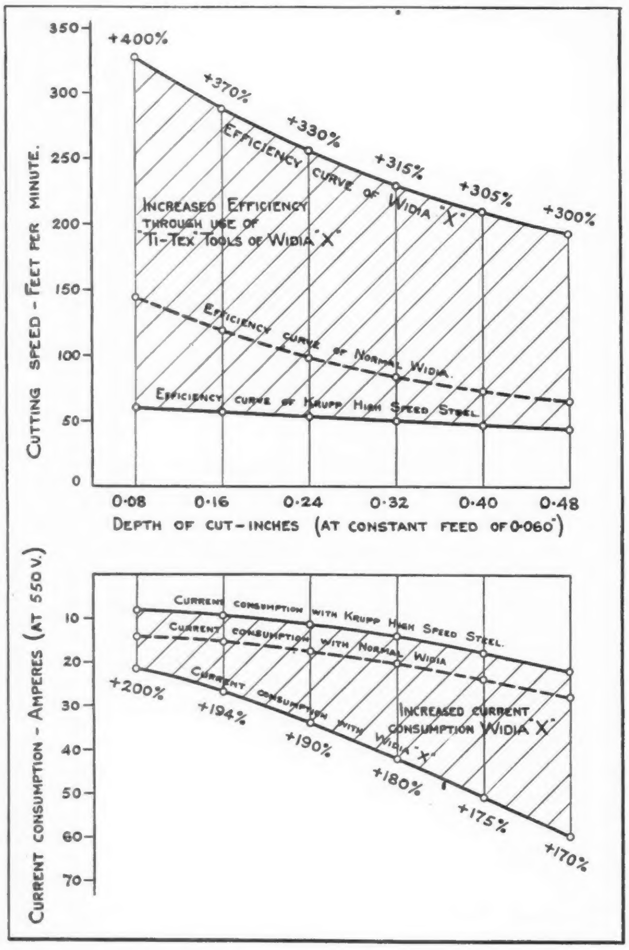


Fig. 1. Curves that Show the Efficiencies of Widia-X in Tests on Steel, and the Corresponding Consumption of Electrical Current

Charts (see Fig. 1) were made up on the basis of a test conducted in a lathe on a chrome-nickel steel bar 12 inches in diameter, having a Brinell hardness of 295. A constant feed of 0.060 inch per spindle revolution was used, with various depths of cut. The upper chart makes interesting comparisons between Widia-X, Widia-normal (tungsten carbide), and Krupp's best high-speed steel. It will be seen that the efficiency of Widia-X in this test ranged from 300 to 400 per cent of the efficiency of the high-speed steel.

The lower chart shows the relative corresponding power consumption in each case. It will be noted that the greatly increased cutting speeds possible with Widia-X did not cause corresponding increases in power consumption. For example, the increased cutting speeds of 300 and 400 per cent caused increased power consumption of only 170 and 200 per cent, respectively. Thus, the tests indicate that a considerable decrease in power required per pound of metal removed can be effected, in addition to the savings obtainable through the greatly increased cutting speed and length of tool life between grinds.

The chart Fig. 2 shows the increased efficiency of Widia-X over Krupp's best high-speed steel in machining steels of various Brinell hardness numbers, stainless steel, steel castings, and 12 per cent

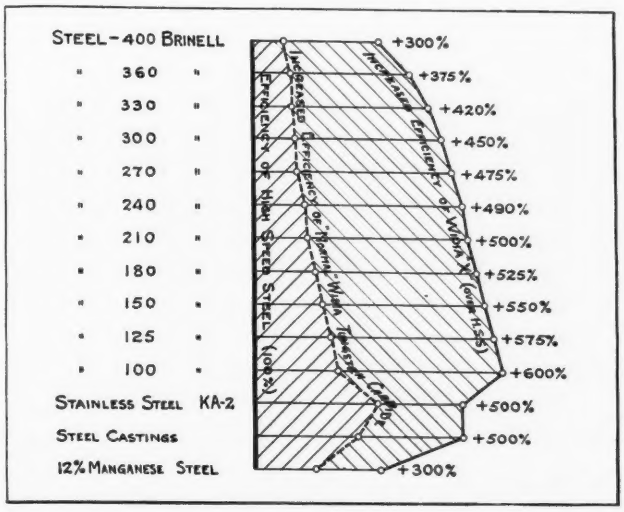


Fig. 2. Efficiencies of Tools Tipped with Widia-X in Machining Various Steels, Compared with the Efficiency of Krupp's Best High-speed Steel

manganese steel. It will be seen that with the efficiency of the high-speed steel given as 100 per cent, the increased efficiency of Widia-X in these tests ranged from 300 to 600 per cent. The increased efficiencies were obtained by increasing the cutting speeds, while maintaining the same rates of feed and depths of cut.

A characteristic of Widia-X that makes it especially suitable for cutting steel is the absence of the usual cratering action or cupping of the top surface of the tool that is caused by the pressure and abrasion of the chips when tungsten carbide is used in machining steel. Thus, it is possible with Widia-X to take finishing cuts on soft steel. The new cemented carbide is not intended for heavy hogging cuts at slow speeds. It is essentially a high-speed material and best results are obtained when speeds can at least be doubled and reasonably light feeds employed.

Cutting tools with tips of Widia-X are sold by Thomas Prosser & Son under the trade name of "Ti-Tex." These tools should be set up in machines in the same way as tungsten-carbide tools. They should be held firmly, and as close as possible to the cutting edge. Care should be taken to avoid all causes of chatter or vibration.

The tools should be set above center an amount ranging from 1 to 2 per cent of the work diameter. From Fig. 3 it will be seen that if the tool is set above center, a much better support will be provided for the cutting edge against the pressure of the chip than if the tool is somewhat below center. In boring, the conditions are reversed, and the tools should then be set directly on center. These tools can be run dry or with a lubricant, but the life between grinds and the cutting speed can be increased by the use of a cutting compound.

"Ti-Tex" tools should be ground in the same way as tungsten-carbide tools and by the use of the same special grinding wheels. The clearance should be kept small (about 4 degrees for most work), and hollow grinding should be carefully avoided. The included angle of the cutting lip for various steels should be about as follows: Soft steel, 65 degrees; hard steel, 65 to 74 degrees; 12 per cent manganese steel, 80 to 84 degrees; stainless steel, 65 to 74 degrees; soft steel castings, 68 to 73 degrees; and hard steel castings, 73 to 78 degrees. A 70-degree lip with 4 degrees clearance is suitable for the average turning of steel, but where much work is to be done on the same steel, the correct angle should be determined with care.

It is sometimes necessary to grind a "chip breaker" on the tip so that the chip will curl properly. When this is required, however, care should be taken *not* to hollow-grind the top of the tool. Instead, a small flat area should be ground back of the cutting edge and parallel to the top surface, with a fillet joining it with the top surface, as shown in Fig. 4. The width of the flat and the radius of the fillet can be proportioned to give the chip the proper amount of curl.

Extensive field tests have been run on "Ti-Tex" tools. In a lathe operation on a chrome-nickel steel corresponding to S A E No. 3335, a speed of 197 feet per minute was used, together with a feed of 0.060 inch per spindle revolution, and a depth of cut of 0.40 inch. After five minutes use, the tool was examined under a microscope. No wear or

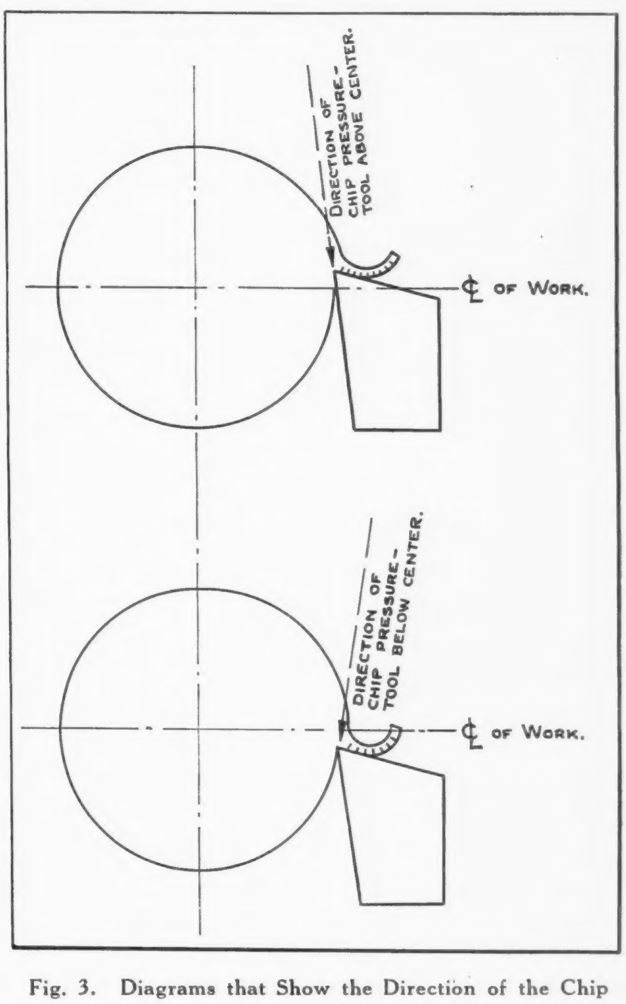


Fig. 3. Diagrams that Show the Direction of the Chip Pressure with a Cutting Tool Positioned above and below the Center Line of the Work

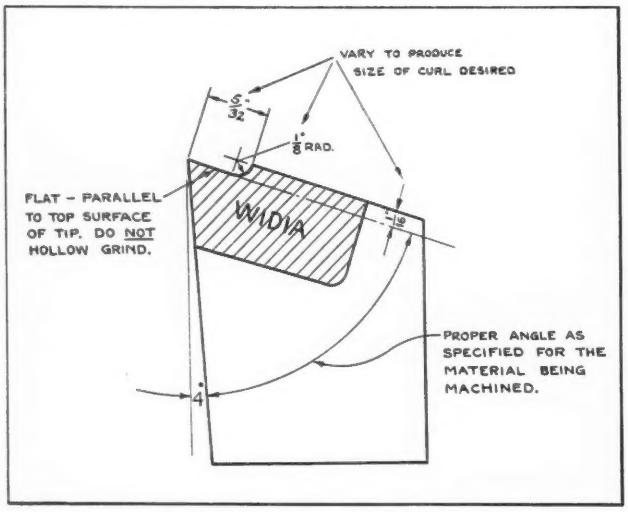


Fig. 4. Diagram Illustrating the Preferred Method of Grinding a "Chip Breaker" on Widia Cutting Tool Inserts

cratering action was discernible. On the other hand, a tungsten-carbide tool used under the same conditions showed a deep crater after 1 3/4 minutes use. The color of the chip made by the "Ti-Tex" tool indicated that less heat was developed, and the chips came off without any tearing action, leaving a finer finish.

The heading illustration shows a slab milling operation on an S A E No. 1020 steel. The surface machined was 12 inches long by 3 1/2 inches wide. A series of successive cuts was taken on this metal, starting at a cutter speed of 150 feet per minute, a table feed of 9 inches per minute, and a 1/16 inch depth of cut, and ending with a cutter speed of 387 feet per minute, a table feed of 42 inches per minute, and a 1/16 inch depth of cut. The "Ti-Tex" tool used in this test made twenty more cuts at the highest speed than the other hard alloy tools tested with it, and was still in good condition at the conclusion of the test.

In turning S A E No. 1315 steel at a surface speed of 359 feet per minute, which was the capacity of the old lathe used, a "Ti-Tex" tool ran for fifteen hours before regrinding was necessary, while another hard alloy tool required grinding every six hours. Resharpening required the removal of only 0.010 inch of stock from the Widia-X tip.

* * *

Dial-Graduating Tool for Milling Machine

By HANS POKORNY

The tool here illustrated is employed on a milling machine for graduating dials such as shown at *W*. The tapered shank *B* of the tool fits into the milling machine spindle, which serves simply as a holder for the tool and is clamped to prevent rotation during the operation. In the body *A* is a disk with a cam slot or spiral groove *D* in it. The disk has a shank to which the operating handle *E* is secured. A roller pin *C* in the slide *G* projects upward into the cam slot *D*, so that the slide *G* can be moved back and forth by means of the handle *E*.

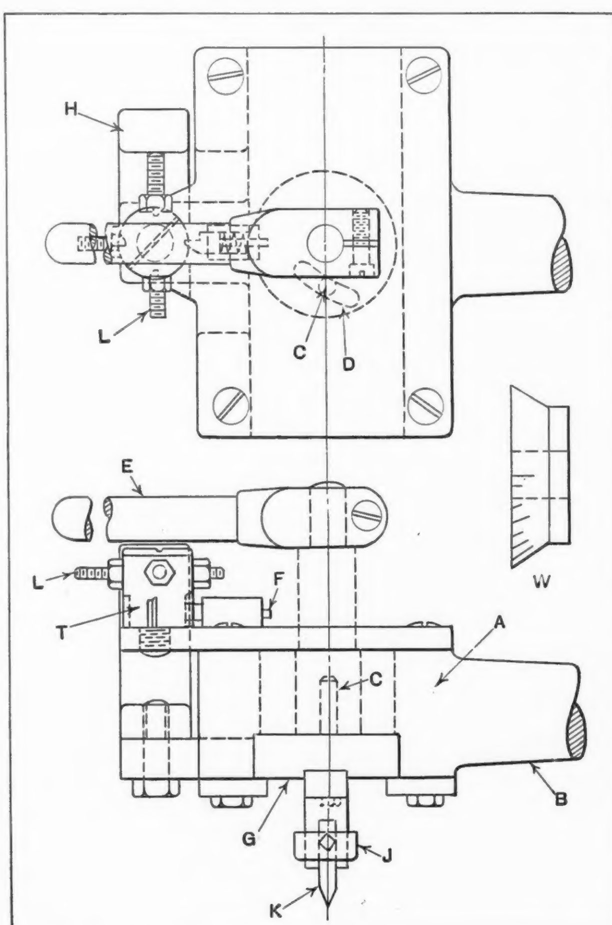
Fastened to the under side of slide *G* is a holder *J* for the graduating tool *K*. On the outer side of the slide is a stop *H*. Both the stop and the tool-holder are made reversible so that the scribing cut can be taken by moving the slide in either direction. A four-station turret *T* with adjustable set-screws *L* is provided for governing the lengths of the graduating lines. A reversible ratchet pin *F* serves to lock the turret in any of the four positions.

The work to be graduated is held on an arbor in the dividing head. The machine table remains stationary during the graduating operation. It is obvious that moving the graduating tool consumes less time than feeding the milling machine table, as was previously done. The actual cost for graduating dials of the type illustrated has been reduced more than fifty per cent by the use of this tool.

* * *

A New Lighter for Gas Appliances

A convenient device for industrial plants has been brought out by the Modern Engineering Co., 3411-13 Pine Blvd., St. Louis, Mo., in the form of a lighter for lighting welding and cutting torches and all other kinds of gas appliances in the shop. The lighter is rigidly constructed and provided in the original design with three renewal flints which can be used successively until worn out.



Tool Used for Scribing Graduation Lines on Dials

Advertisements as a Source of Information

By JOHN BRADFORD

MEN who have been trained along engineering or mechanical lines are, as a class, of an inquiring "turn of mind." Their daily work emphasizes the importance of acquiring as much information as possible. How to obtain it by expending a minimum of time and effort is well worth considering.

Assume, for example, that a young man is ambitious to become an expert in machinery manufacturing practice, with the idea of fitting himself for a position as superintendent or works manager. To secure and hold a job of this kind usually requires a broader fund of knowledge than can be obtained through one's own personal experience. One way to supplement this experience would be by visiting a lot of well equipped shops or plants in order to study their equipment and practice first hand. While this method would be effective, very few can adopt it because of the time required, to say nothing of the expense.

Technical journals provide a much more direct and efficient way of obtaining similar information. They serve as a clearing house and are equipped to collect news about the varied developments in equipment and practice—the same kind of information that one might acquire by extensive visiting of shops. This function of the technical journal is quite generally recognized among experienced men in the mechanical field, so far as the "reading" pages are concerned. Too many, however, overlook the advertising pages as a source of information, because they regard this section as a place for selling propaganda only.

Why the "Ad" Reading Habit Pays

In the early days of trade journal publishing, advertisements were little more than bare announcements, but now many advertisements supplement the sales appeal with considerable technical information, because it is believed that "cold facts" of the right kind have a "lot of punch." Modern advertisements make it possible to keep in touch with the latest developments in equipment and materials at a minimum expenditure of time and effort. Take the advertising section of MACHINERY as an example. By referring systematically to this section, the shop executive can readily keep himself informed about modern types of machine tools, small tools, transmission devices, unit machine parts, material-handling apparatus, and other developments. Many of these products are familiar to men of wide experience, but the habit of giving the advertising section a careful "once-over" may safeguard even the wisest against lack of information about some new machine or material that would fit in with a given job or process and possibly result in a big saving.

What kind of specific technical information can be found in advertisements? The writer wanted to know himself and selected the November number of MACHINERY for a test. The first thing that turned up was quite unexpected—a formula for determining the number of months or years in which equipment will pay for itself through savings. Since this formula is the one employed by a large corporation, it doubtless is reliable. You may wonder why it is used in connection with an advertisement—but that has nothing to do with its practical value.

The test was continued, each "ad" being examined for any information that might be of value to shop executives or engineers. A detailed account of every item resulting from this examination would be too long, but a condensed summary of some of the more unusual ones follows. Most of them probably would constitute news to the average man in the mechanical field.

A modern way of lubricating by piping lubricant throughout the plant in order to have it "on tap" wherever needed is quite fully described and illustrated in connection with one advertisement. In another, information is given about present practice in speed and feed ranges on milling machines.

Abrasive Wheel that Runs Three Miles a Minute

Think of an abrasive wheel running at a surface speed of 16,000 feet (over 3 miles) per minute! Information is given about the bond used and the general application of these wheels.

Do you know that there are special motors for use in hazardous locations where gasoline, naphtha, benzol, or other inflammable liquids are manufactured, used, or handled? Considerable information is given about the details of this special type of motor.

Brass battery nuts require facing, forming, knurling, drilling, and tapping. How fast would you expect to produce them on a commercial automatic screw machine? A production of 180 per minute or three nuts a second is possible.

The advertising pages give considerable production data as applied to an interesting variety of jobs. The page preceding the brass nut job shows a straight-line polishing machine that reduced polishing time from 160 minutes to 3 minutes. It's worth knowing about even if it is "out of your line."

Suppose you wanted to drill a square, hexagonal, or even a triangular hole. Do you know of a commercial drill that will handle work of this kind?

A Little Job that Becomes a Big One

Inserting screws or tightening nuts becomes a real manufacturing problem when a great many

parts must be assembled. The bench type of flexible shaft equipment for this work is shown in the advertising section and information is given about typical applications. Other flexible shaft applications referred to in this general section include the driving of rotary files, grinding wheels, rubber polishing wheels, etc., in connection with precision die work and toolmaking where hand-manipulated tools are required.

A modern method of gear construction proved interesting. The gears are built up by welding together sections of rolled-steel plate in order to obtain gears free from hidden blow-holes and casting strains, with a higher tensile strength and longer life.

Suppose the edge of a drawn part has to be trimmed truer and more accurate than is possible in a trimming die. There is commercial equipment for such work.

What would be your guess as to the total tolerance allowable for die-casting a screw thread? One job featured has a pitch diameter tolerance of 0.0015 inch, and two castings are made every "shot."

This list might be expanded further, but it is complete enough to show that considerable useful information may be obtained from advertisements. By turning to the advertising section, it is possible, in a few minutes, to survey the most modern equipment that has been developed for one of our most important industries. In a sense, the advertising section is like a plant containing a large variety of equipment representing the last word in design and efficiency.

* * *

Conference on Welding Methods

The Northwest Chapter of the American Society for Steel Treating, in conjunction with the Manufacturers' Association of Minneapolis, Minn., held a meeting November 19 to 21, at the plant of the Caterpillar Tractor Co., Minneapolis, at which time welding methods were thoroughly discussed. The new code for welded pressure vessels, the testing of welds, hard surfacing, automatic welding, the shielded arc, pipe welding, and bronze welding were among the subjects covered in well prepared articles and addresses. In addition to the papers read, there were demonstrations of both gas and electric welding, showing the most modern methods as well as appliances.

* * *

Columbia University has announced the opening of special classes in its engineering school for the benefit of unemployed professional engineers. Applicants may obtain a certificate from the Engineers' Unemployment Committee located in the Engineering Societies' Building, 29 W. 39th St., New York City. No fees are charged. The object of the courses is to give men an opportunity to improve their ability while unemployed.

Konel, A Platinum Substitute

In the early radio sets, tubes with platinum filaments were used. With the growth of the radio industry, as well as of other electrical applications of platinum, this metal was found to be rather too scarce and expensive for wide application. Through persistent research, a substitute was found in the form of a new alloy known as Konel, consisting mainly of nickel and cobalt. The new alloy, developed by the Westinghouse laboratories, has proved itself not only equal, but superior to platinum for the purposes for which it has been developed.

Not only does it have the remarkable resistance to acids and corrosion possessed by platinum, but it has greater strength at red heat and better electrical qualities as a filament. There is one use for platinum, however, for which it cannot serve as a substitute, and that is for jewelry, for it costs not $100 an ounce or more, but only a few dollars a pound. One of the interesting characteristics of Konel is that it retains remarkable strength at high temperatures. In fact, if a steel wire of the same diameter as a Konel wire is heated to a red heat, the hot Konel wire will be found to be stronger than the steel wire.

* * *

A Solder for Aluminum

A solder that will repair aluminum parts, as well as parts made of cast iron or steel, has recently been produced by the Allied Research Laboratories, Glendale, Calif. This solder, which is known as "Alumaweld," has a tensile strength of about 12,000 pounds per square inch. It is very ductile, and can be polished to receive chromium plating or other plating. The solder will repair die-castings, cylinder heads, crankcases, pipe lines, etc. It is applied to aluminum by means of an ordinary soldering iron or a torch, without a flux. For cast iron and steel a special flux is required. The solder will not corrode under ordinary circumstances.

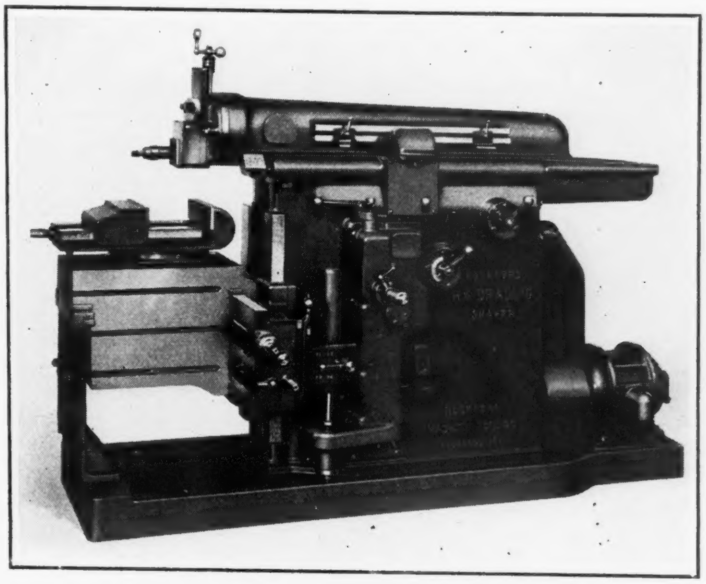
* * *

The International Acetylene Association held its thirty-second annual convention at the Congress Hotel, Chicago, Ill., November 11 to 13. One of the features of the convention was a comprehensive discussion on the methods for testing oxy-acetylene welded joints. At this session, Professor H. L. Whittemore of the United States Bureau of Standards spoke on the importance of tests, both to welders and to users of welded products. A demonstration of the different tests suitable for inspecting welded joints was made at the meeting. The uses of the oxy-acetylene process of welding in different industries were dealt with by a number of speakers of broad practical experience. The office of the International Acetylene Association is at 30 E. 42nd St., New York City.

New Shop Equipment

Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts and Material Handling Appliances

Rockford Shaper with Hydraulically Operated Ram and Table



Rockford "Hy-Draulic" Shaper which has an Unlimited Number of Speeds and Feeds up to the Maximum

Hydraulic power is used for driving the ram and feeding the table of a shaper that is being introduced on the market by the Rockford Machine Tool Co., Rockford, Ill. Through the use of hydraulic power, both the cutting speed and the cutting pressure are uniform from the beginning of each cut to the end. Smoothness of control is one of the features, it being stated that the ram cannot "run away" if the cut diminishes or is intermittent. Also, chatter marks are eliminated on the work. The reversals of the ram are obtained rapidly and without shock. Any number of ram strokes is obtainable up to 150 per minute by operating two ball-end handles.

Another advantage of this design is that any return ram speed may be selected between a maximum ratio with the cutting speed of 3.73 to 1 and a minimum ratio of 1.80 to 1. Power is applied to the ram in a straight-line direction, right in back of the tool. Both the length and the position of the stroke relative to the work are governed by a pair of dogs mounted in a T-slot on the right-hand side of the ram. Stroke adjustments can be made safely while the ram is in motion without the use of any tools. By operating a ball-end handle, the direction of the ram travel can be reversed at any point, even with the tool taking a heavy cut. At the moment that the tool enters a cut, or when the tool encounters a hard spot in the work, the oil in the hydraulic system absorbs the shock. Unusual lightness of the moving parts in the ram drive is another feature of the construction. The ram-driving mechanism is self-lubricating.

Any desired rate of table or rail feed up to a maximum of 0.160 inch per ram stroke is obtainable by merely adjusting the thimble of the "Micro-Feed" with which this machine is equipped. Feed adjustments can be made while the ram is in motion. The feeding movement takes place practically instantly after the tool has cleared the work on the return stroke. The hydraulic drive for the feeding mechanism is independent of the ram drive.

Three levers control the direction of the table movements to the right or left and up or down; the power elevation or cross-travel of the table; and the starting or stopping of the machine, and the feed or rapid traverse of the table or rail, respectively. Automatic stops at the ends of the rail control the extreme ends of the table feed or rapid traverse.

The important specifications of this shaper are as follows: Minimum and maximum lengths of stroke, 1 and 25 inches, respectively; range of cutting speed, from 0 to 120 feet per minute; dimensions of table top, 16 by 24 inches; horizontal table travel, 30 inches; vertical table travel, 14 inches; maximum distance from table to ram, 18 inches; vertical feed of ram head, 7 inches; size of motor, 10 horsepower; and net weight of machine, about 6200 pounds.

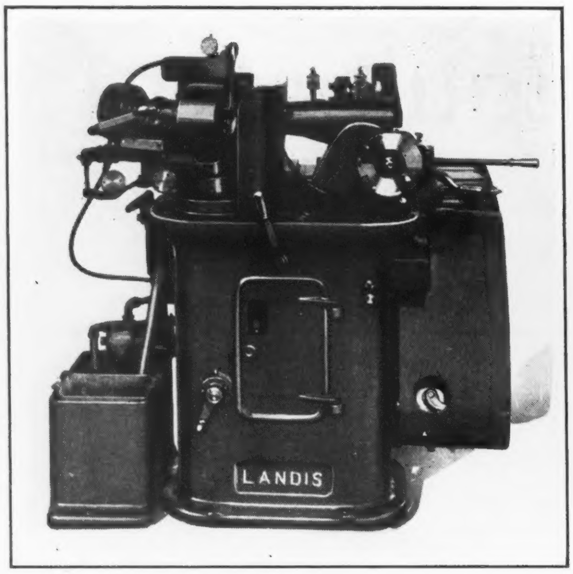


Fig. 1. Landis Motor-driven Ball-race Grinder with Sizing Device

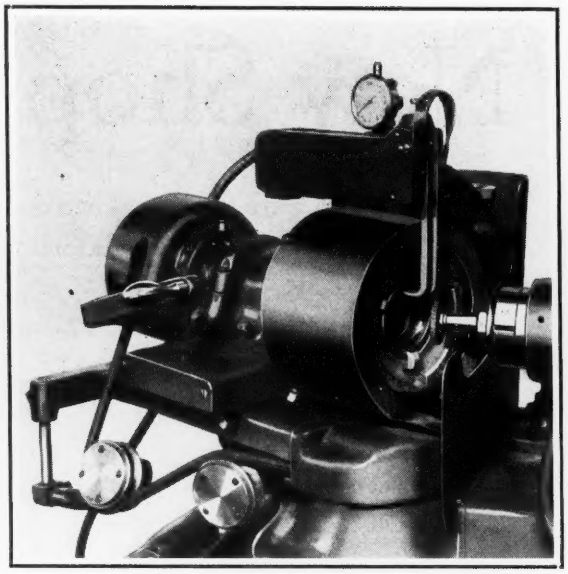


Fig. 2. View of Work-head with Sizing Device in Operative Position

Landis Ball-Race Grinding Machine

The new features of an improved ball-race grinder now being placed on the market by the Landis Tool Co., Waynesboro, Pa., consist of a sizing device and a motor drive. In other respects, the machine is similar to the previous Landis grinder of the same type. It is designed for grinding the grooves in both inner and outer ball races, as well as other types of miscellaneous work within its range.

The operation of the machine is semi-automatic. After loading the work and swinging the sizing device into its operative position, the operator moves the wheel in to the work and starts the grinding. The wheel automatically feeds in steadily from this point, advancing a predetermined amount twice within the space of one oscillating movement of the work-head. When the raceway has been ground down almost to size (say within 0.001 inch, although this figure may be changed at will), the automatic wheel-feed mechanism is disengaged by means of a solenoid controlled by the sizing device.

The remaining stock is then quickly removed without further feeding in of the wheel. As soon as the raceway has been ground down to the desired size, the wheel moves back a few thousandths of an inch from the work. This movement is controlled by a second solenoid, which is also actuated by the sizing device. The operator finally gives the feed-up handwheel an approximate half-turn clockwise to move the wheel far enough away from the work for reloading.

The grinding-wheel spindle runs in duplex-type preloaded ball bearings, and is driven from a jack-shaft which receives power from a short driving drum at the rear of the machine. The grinding-wheel feed can be adjusted at the end of each half stroke of the oscillating work-head to reduce the diameter of the work from 0.00025 to 0.0015 inch during the next half stroke. The conventional Landis feed-up handwheel is used. The grinding wheel carriage is moved toward and away from the work by means of a rack and pinion arrangement.

The work-carrying head oscillates automatically, and is provided with adjustments for varying the length of arc through which it oscillates. The vertical oscillating spindle is fitted with a duplex-type preloaded ball bearing at the upper end and a bearing of another type at the lower end. Backlash or shock at the ends of the oscillation are guarded against.

The arrangement for driving the work-head spindle is unusual. A driving shaft which extends through the hollow vertical oscillating spindle is provided with a grooved pulley at the top which transmits power to the left-hand end of the work-spindle by means of a round leather belt. There is also a grooved pulley at the lower end of this driving shaft to which power is delivered through the medium of a second round leather belt.

The sizing device is mounted at the rear of the work-carrying head. It can be easily swung into and out of the operative position. A dial indicator graduated to 0.0001 inch, together with convenient adjustments, enables the operator to change the point at which the feed-in movement stops.

The entire machine is driven by a two-horsepower constant-speed motor mounted at the rear of the bed. Through the use of a two-step driving pulley, two work speeds and two work-head oscillating speeds are available. The net weight of the machine is 2000 pounds.

Barber-Colman Hobbing Machine

The latest addition to the line of hobbing machines built by the Barber-Colman Co., Rockford, Ill., is the Type A here illustrated, which comprises a further development of the principles of design on which the No. 12 machine was based. The new model is somewhat more rugged than its predecessor and has a slightly greater capacity, both as to diametral pitch and length of load that can be placed on the arbor. It is also more accurate as regards the spacing of the gear teeth and their form. Another feature is that various attachments furnished as separate units for the No. 12 machine are built into the Type A machine.

The work-spindle runs in double opposed taper bronze bearings, so arranged that the front and rear bearings can be independently adjusted as required. This feature permits the maintenance of correct clearances at both ends of the spindle, and eliminates undue looseness or play of the work and the index worm-gear. The work-spindle slide can be adjusted to the desired position by means of an elevating screw equipped with a micrometer dial reading to 0.001 inch. The work-spindle slide carries the index worm-gearing in a case having an oil reservoir which insures continuous lubrication of the mechanism.

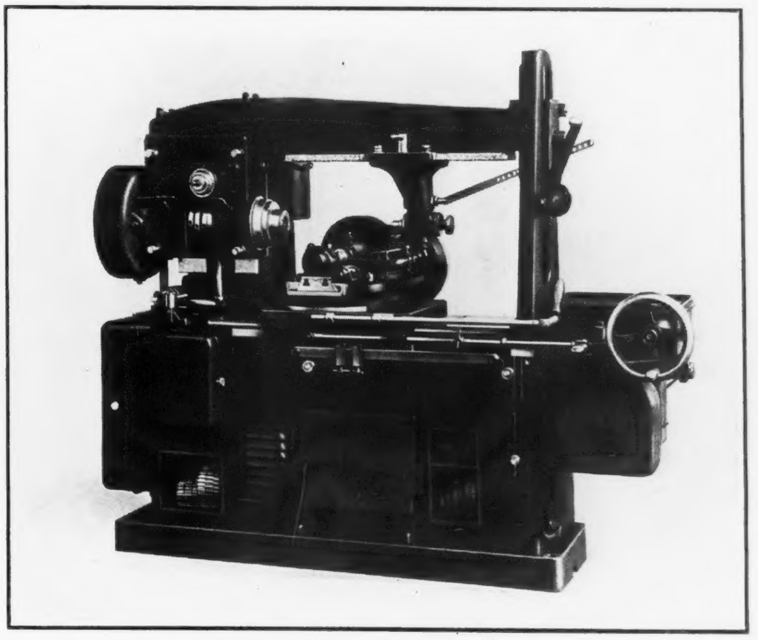
The work-arbors are supported at the outer end by an over-arm bracket or tailstock which is provided with a clamp handle and a rapid unloading device. The bracket can be released quickly and moved out of the way for changing the load. It can be fitted with a hardened and ground adjustable steel center, as shown, or with a bronze bushing to receive a sleeve that is clamped on the work-arbor. For handling spline shafts, special means are generally used to support the outer end of the shaft. The work-spindle has a B & S No. 12 taper hole, but it can also be arranged with a collet chuck on the nose to support work that cannot be held on an arbor.

Improved means have been provided for taking up wear between the index worm and worm-gear. The hob-spindle is also adjustable for wear, and runs in Timken roller bearings. For relocating the hob after it has become dull in one position, the hob-spindle slide can be moved lengthwise by means of a screw equipped with a micrometer dial. The hob-slide swivel gives a range of helical settings 50 degrees each side of zero. A vernier reading to 10 minutes is provided, which insures accurate settings.

One of the features of the machine is an automatic "stabilizer," which consists of a braking device that creates a drag on the hob swivel-slide, eliminating backlash in the feed-screw and preventing the slide from jumping when the hob chatters in the work. The stabilizer can be disconnected when desired by pulling out a small knob on the front of the bed. The rapid traversing speed of the hob swivel-slide is 70 inches per minute. Gears in the box at the right-hand end of the bed control the rate of feed-screw revolutions, and consequently the speed at which the hob swivel-slide is traversed.

The speed change-gears are mounted at the front of the bed and protected by a heavy guard. A combination of automatic stops enables the machine to be set up for almost any desired cycle of operation. Stops are provided on both the feed and rapid traverse mechanisms, and there is another stop that automatically throws out the clutch of the main drive at the end of an operation. A one-shot oiling system insures lubrication of all bearings, while a pump with a capacity of 20 gallons per minute delivers coolant to the work from a reservoir located in the bed.

Some of the important specifications of this machine are as follows: Maximum diameter of work, about 12 inches; maximum width of work, about 12 inches; distance from center line of work-spindle to over-arm, 8 inches; distance from center line of work-spindle to center line of hob-spindle, 8 3/4 inches; travel of hob swivel-slide, 17 1/2 inches; and net weight of machine, 5635 pounds. Gears of 3 diametral pitch can be cut in cast iron, and gears of 4 diametral pitch in steel.



Barber-Colman Type A Hobbing Machine Developed from the Previous No. 12 Machine

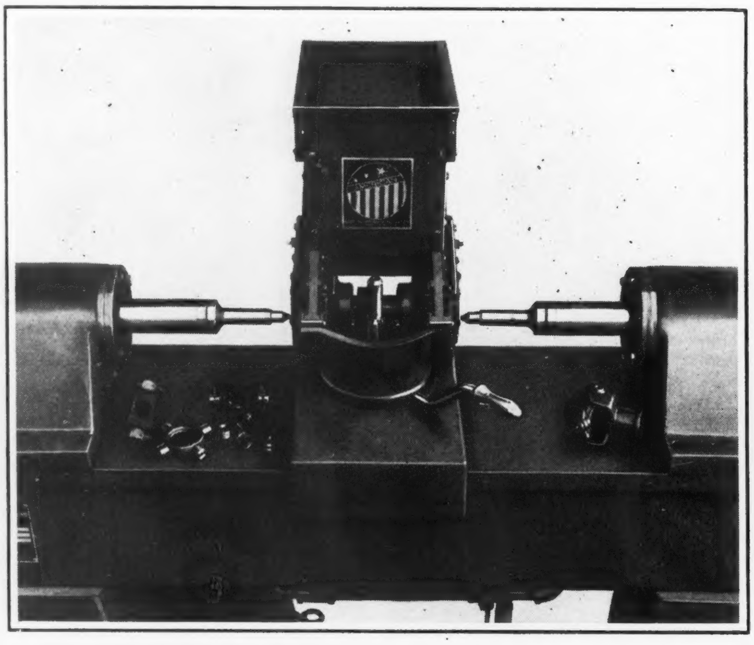
American Two-Spindle Hydraulic Assembling Machine

A special horizontal machine equipped with two opposed spindles or rams and a magazine feed was recently built by the American Broach & Machine Co., Ann Arbor, Mich., for assembling bushings in Spicer-type universal joints. In assembling these joints, the yoke with the short hub is dropped over the vertical splined shaft seen in the center of the machine. The cross member is then dropped into position on this yoke and the second yoke is placed on top of the cross.

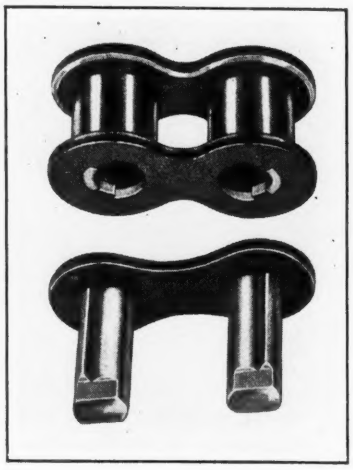
By depressing the foot-pedal, the two rams are advanced, a hardened sleeve on the end of each ram receiving a bushing from the magazine. As the rams continue advancing, the centers in the rams raise the cross member of the universal joint into line with the bushing holes in the yokes. When the rams advance still further, they press the bushings into the yoke. While the operation is in process, the centers withdraw into their spindles so as to allow the bushings to be pushed into the yoke holes to the proper depth.

As soon as the foot pressure is released, the two rams withdraw from the fixture. The operator then pulls the hand-lever a quarter turn so as to position the universal joint members for assembling the remaining two bushings at right angles to the first two. The whole assembling operation takes about 12 seconds.

Operation of the rams is effected hydraulically by an oil-pump submerged in an oil reservoir in the left-hand column of the machine. The stroke of each ram is adjustable. This machine is driven by a three-horsepower motor and weighs 2000 pounds.



Machine Built by the American Broach & Machine Co. for Assembling Universal Joints



Roller and Pin Links of Morse Roller Chain

Morse Roller Chain

A roller chain has been placed on the market by the Morse Chain Co., Division of Borg-Warner Corporation, Ithaca, N. Y., for slow-speed drives, second-reduction drives, and drives built into machines. Within each roller of this chain there are two joint members, a segmental bushing and a pin. The cross-section of the pin is that of a round pin integral with a segmental bushing. On account of this construction, when a chain is flexing on or off a sprocket, all sliding movement of surfaces under load is between the pin and its bushing, or specifically, no movement under load occurs between the roller and the joint members. This feature is claimed to insure uniformity of pitch throughout the chain life, and, as a result, smooth and quiet operation.

The open spaces between the joint members provide reservoirs for oil, and the lubrication is made more effective by the pumping action when flexing. This chain is interchangeable on all standard roller sprockets.

Howell Automatically Oiled Motors

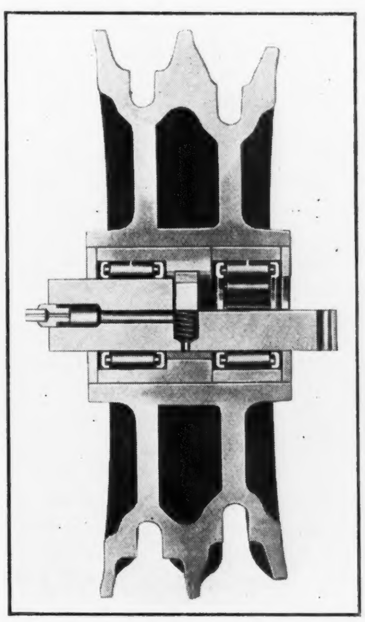
Automatic oiling is a feature of a fractional-horsepower condenser-start induction run motor manufactured by the Howell Electric Motors Co., Howell, Mich. This motor has two oil wells, one for each bearing. Both wells have sufficient capacity to provide lubrication over a long period of time. The sleeve bearings are packed with wool yarn, and a wick runs to the bottom of the well, carrying oil from the reserve supply to the bearing only as needed. The wells are connected with each other at the bottom by means of a pipe line, which gives the advantage of one-point lubrication through the self-leveling feature.

"Little Wizard" Chain Hoist

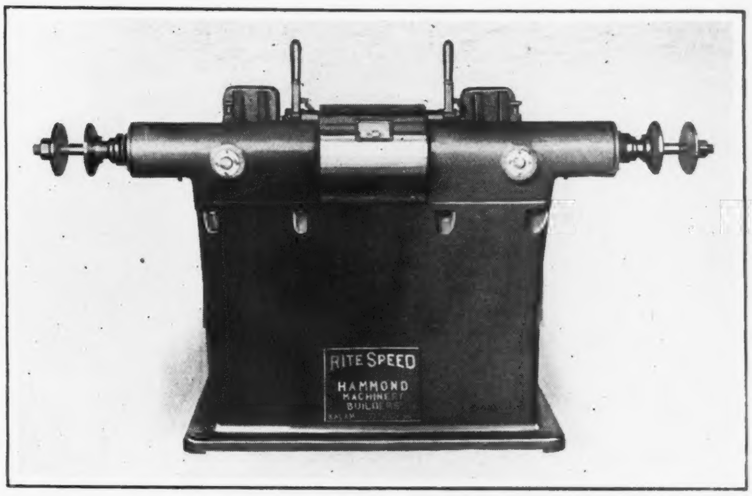
Minimum friction is one of the principal features claimed for a chain hoist now being placed on the market in 1/2 and 1-ton sizes by David Round & Son, Cleveland, Ohio. The top sheave of this hoist is equipped with double roller bearings as illustrated. These roller bearings are placed on each end of the sheave shaft, with the internal ratchet between them. The collar in which the roller bearings ride is made in two parts. The left-hand section of the collar, as seen in the illustration, contains the internal ratchet.

The ascending load rides on both roller bearings. However, the descending load rides on the friction bearing of the collar that contains the ratchet and on the roller bearing of the other collar section. The bottom sheave of the hoist is provided with single roller bearings.

Both the top and bottom sheaves are lubricated on all load-bearing surfaces by the Alemite-Zerk pressure system. The internal ratchet sustains the load at any point. The 1/2-ton hoist weighs 31 pounds, and the 1-ton hoist, 52 pounds.



Top Sheave of "Little Wizard" Chain Hoist



"Rite Speed" Polishing and Buffing Lathe with Separate Motor Drives for the Two Spindles

"Rite Speed" Two-Motored Polishing Lathe

Two motors of 3, 5, 7 1/2, or 10 horsepower are provided on the Type CCO heavy-duty polishing and buffing lathe which has recently been added to the line of grinding and polishing machinery built by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. Each spindle of this machine has its own motor, starter, multi-vee belts, switch, and brake. Thus the spindles can be operated independently of each other.

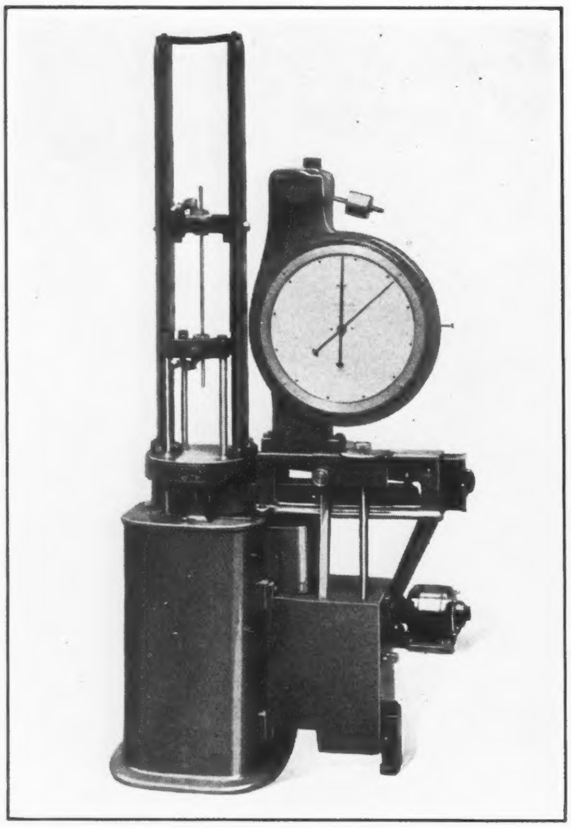
This machine is recommended for use where wheel changes are frequent or the operation requires two different speeds. Any desired spindle speed can be provided. The spindles overhang 8 inches from their centers to the front of the pedestal.

The tension of the multi-vee belts is adjustable by means of screw-feed slide rails on the rear of the pedestal. Either the standard Hammond oiling system or a cascade oiling system can be provided. In the latter system, an oil-pump driven by worm-gearing forces the oil through a Purolator filter and then through a continuous passage to the outside of the bearings, whence it is returned to a large reservoir to be used over again.

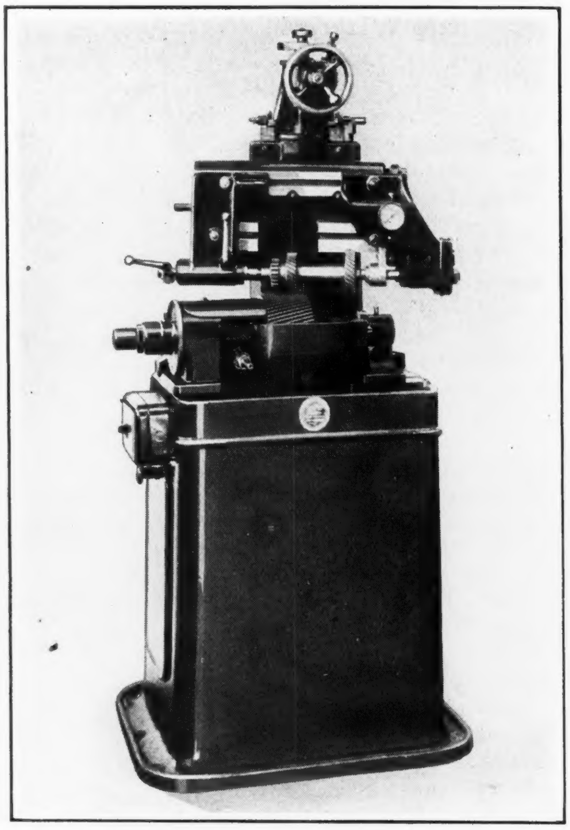
Olsen Hydraulic Type Universal Testing Machine

A hydraulic universal testing machine with a lever-weighing and pendulum dial indicating system has recently been placed on the market by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa. This machine combines the flexibility of a hydraulic loading system with the convenience and accuracy of a dial indicating mechanism. The dial is mechanically operated under the control of levers and a pendulum. The dial is large and the pointers can make two complete revolutions. This provides the equivalent of two dials in one and enables the operator to read small increments of load.

The loading system consists essentially of a hydraulic cylinder and piston located in the machine base. The piston is connected to the four straining rods attached to the moving cross-head which grips the lower end of the specimen being tested. As the pressure in the hydraulic cylinder is increased, the lower cross-head moves downward, and tension is applied through the specimen to the upper adjustable cross-head and then downward through the two side columns to the weighing table. This table



Olsen Testing Machine with Hydraulic Loading System and Dial Indicating Mechanism



Gear-tooth Lapping Machine that Applies a Uniform Load on Surface being Lapped

does not touch any part of the straining system.

Through a system of levers, the load on the weighing table is transmitted to the pendulum on the back of the upright housing at the rear of the dial. The movement of this pendulum actuates the dial pointers and shows the load being applied to the test specimen direct in pounds. One of the dial pointers moves forward or backward constantly as the load is increased or reduced. The second point is drawn forward by the first and always indicates the maximum load that has been applied to the specimen. When the specimen breaks, the second pointer remains at the breaking load until set back by the operator.

The machine shown is of 20,000 pounds capacity, but larger machines of the same type can be supplied. The pendulum-dial weighing system can also be substituted for the scale-beam system used on Olsen screw-driven universal testing machines.

"Red Ring" Gear-Tooth Lapping Machine

On the Model GLF gear-tooth lapping machine recently brought out by the National Broach & Machine Co., Shoemaker and St. Jean Sts., Detroit, Mich., there is a power tailstock that applies a uniform load on the surface being lapped. The load is applied by an oil brake, which is adjustable. On certain types of work, this feature permits a modification of the tooth shape.

As on previous machines built by this company, the axes of the lap and gear are not parallel. By reciprocating the gear, the lapping action is spread across the gear face. A reversing switch permits lapping on both sides of the teeth.

The machine is used chiefly for lapping spiral gears. Transmission gears up to 7 inches in diameter can be accommodated. Transmission gears are lapped in from three to five minutes.

H-P-M Oil-Pressure Presses

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has developed a new series of hydraulic assembling presses intended for use chiefly as quantity production machines. These presses, one of which is shown in the illustration, are of the open gap type, thus providing easy access to the work from both sides, as well as from the front. The press frame is a heavy one-piece casting with a deep backbone section. Oil storage is provided for in the upper section. The oil is intended both as a pressure fluid and a lubricant.

The power unit is completely enclosed, the pressure pumps being mounted on a baseplate and completely surrounded by the pedestal. Access is afforded to

the interior of the press through openings on each side, which are normally covered by plates.

The operating system consists of a rotary-type low-pressure oil-pump which rapidly advances the ram to the work, and a radial-type high-pressure oil-pump which generates the full working pressure of the press ram. Thus there are two forward speeds—a rapid closing speed and a slower full-load pressing speed. Both pumps are driven by one motor.

Both the forward and reverse movements of the ram are controlled by a manually operated lever. The operator can halt the ram movement anywhere between its neutral position and the extreme points of travel. These presses are available in seven capacities, from 15 to 200 tons.

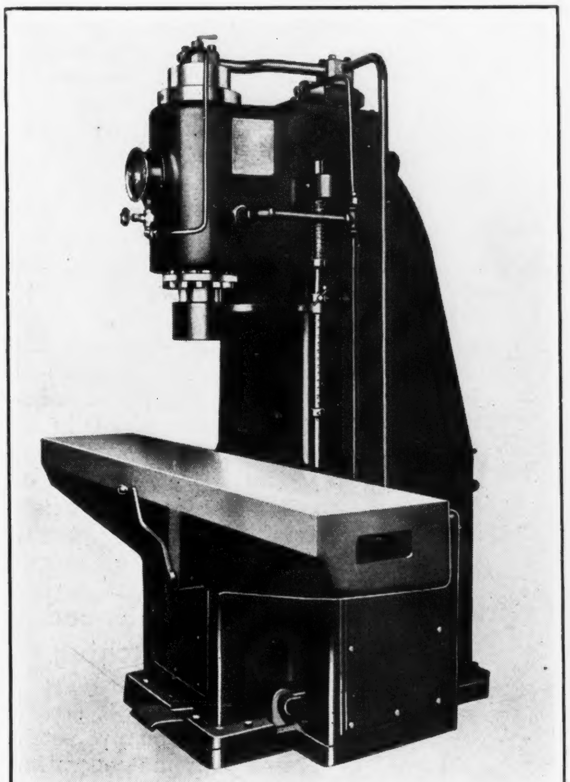
The same concern has also brought out a new series of general-utility oil-pressure presses for automotive plants, railroad shops, foundries, and general machine shops. These presses are intended for forcing and straightening operations in which speed or ease of maintenance are factors. The presses in this line are of the vertical downward-acting, two-rod plunger type. They also are equipped with a rotary-type low-pressure oil-pump for advancing the ram rapidly to the work and a radial-type high-pressure oil-pump for generating the full working pressure of the ram. These presses are built in sizes from 25 to 200 tons.

Baker "Oilfeed" Drilling and Boring Machine

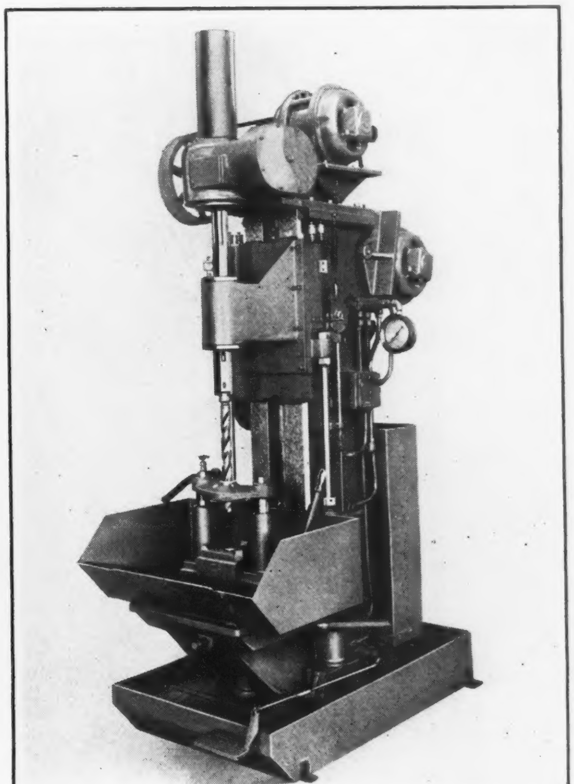
The latest addition to the line of hydraulic-feed machines built by Baker Bros., Inc., Toledo, Ohio, has been designated the No. 4-VH. This machine is adapted either for single-spindle drilling or boring or for use in connection with an indexing table for performing successive operations on the same piece. The particular set-up illustrated is for drilling an automobile cluster gear about 1 1/2 inches maximum diameter and 7 1/2 inches long. Ruggedness, flexibility, and simplicity are the main features of the machine.

The saddle which carries the head mounting is actuated by the patented "Twin Pull" hydraulic mechanism, which comprises two cylinders mounted on the sides of the machine and working in unison. Power for driving the spindle is obtained from a motor at the top of the machine, and is delivered by multiple V-belts to a drive bracket which carries four gears. Two of these are spur gears, which are easily changed to obtain different speeds. The other two gears are of the spiral-bevel type and transmit the power to the spindle.

The speeds available from the combination of gears that can be furnished range from 46 to 836 revolutions per minute. These minimum and maximum speeds give a cutting speed of 60 feet per minute on work 5 inches in



H-P-M Oil-pressure Assembling Press with Rapid and Slow Ram Movements



Baker Drilling and Boring Machine with Pump for Hydraulic Feed Built into the Column

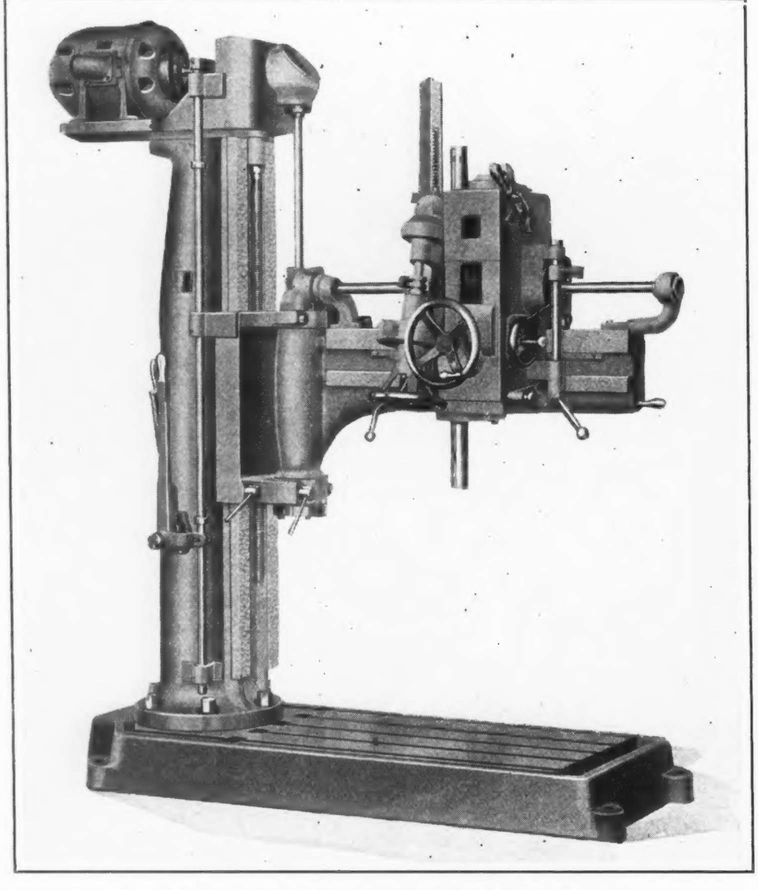
diameter, and 70 feet per minute on work 5/16 inch in diameter, respectively. The motor recommended depends upon the work, but the spindle drive has a capacity for transmitting up to 10 horsepower. The spindle and the gear-shafts of the spindle drive run in ball bearings. Automatic lubrication is provided during operation.

The feed of this machine is obtained through a constant-delivery pump mounted in the main frame and driven by an independent motor. An oil sump of ample size is contained in the frame. The operation cycle of the machine is entirely automatic. When the operator steps on the foot-treadle to actuate the control valve, the spindle moves downward at the rapid traverse rate of 120 inches per minute. It trips automatically into a feeding rate at any predetermined point, drills the work to the desired depth, and then automatically returns to the upper position. The rate of feed can be changed instantly by means of a metering control box.

The illustration shows the machine equipped with a plain table which has a vertical adjustment for setting to the desired height. A box-type table which bolts to the base or an indexing table suitable for multiple operations can also be furnished.

Western High-Speed Radial Drilling and Tapping Machine

Speeds up to 2000 revolutions per minute are available on the radial drilling and tapping machine here illustrated, which is being placed on the market by the Western Machine Tool Works, Holland, Mich. This machine was developed for the drilling and tapping of small holes at high speed and efficiency. It has been designed with a view to driving high-speed taps to their limit of production, with minimum breakage and without damage to the work. The machine is of all-geared design and is equipped with ball bearings throughout, there being fourteen ball bearings in the main drive alone. The spindle is made of crucible steel, and is driven by means of the "Low Hung Drive" which applies the power direct to the spindle at its largest diameter and close to the tool.



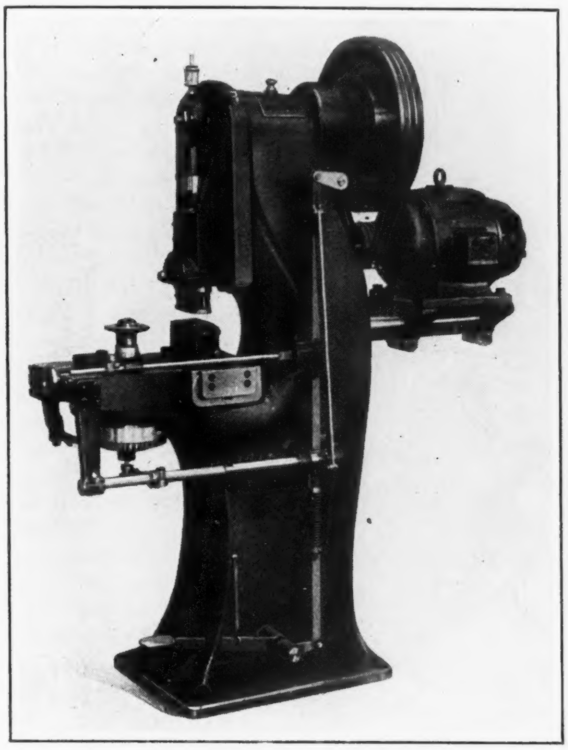
Radial Drilling Machine with Spindle Speeds up to 2000 Revolutions per Minute

Another feature of the machine is the centralized control. All speed and feed changes are made in the head, and the one-lever spindle control, located on the head just to the right of the operator, permits high production to be obtained with small effort on the part of the operator. One handle starts, stops, and reverses the spindle. There are six geared feeds ranging from 0.003 to 0.017 inch per spindle revolution, and six geared spindle speeds ranging from 319 to 2000 revolutions per minute. The machine is equipped with Twin Disc clutches which run in a bath of oil. These clutches are operated from the front of the head by the lever that controls the spindle.

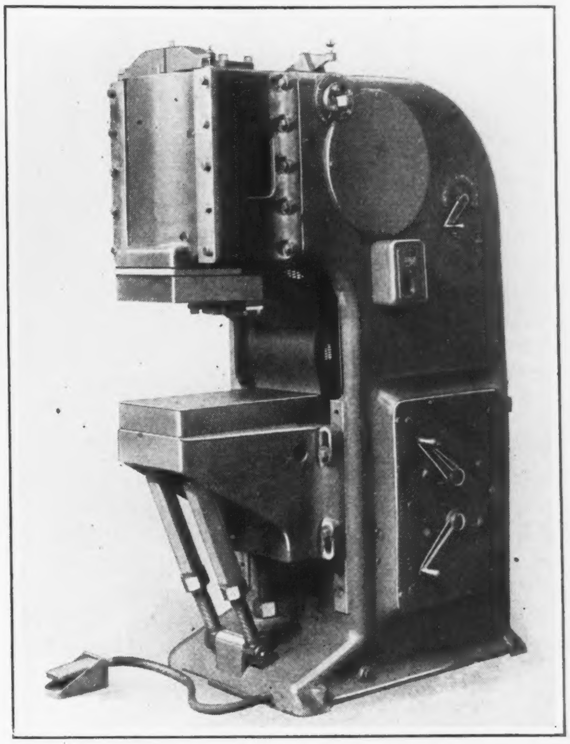
The arm of the machine swings easily on ball and roller bearings. The elevating mechanism is entirely enclosed, and runs in oil. The machine is equipped with automatic knock-offs for the extreme ends of the saddle traverse. This machine is to be made in 3-, 3 1/2-, 4-, 4 1/2-, 5-, and 6-foot sizes, weighing from 3325 to 4375 pounds.

Schatz High-Speed Armature Notching Machine

An automatic armature notching press with an operating speed up to 650 strokes per minute has been placed on the market by the Schatz Mfg. Co., Poughkeepsie, N. Y., for the use



Schatz Armature-notching Machine which Makes up to 650 Strokes per Minute



Taylor-Winfield Welder Designed to Make a Large Number of Projection Welds at One Time

of manufacturers of electric motors. This machine is built in three sizes for disks 29 1/2, 39, and 59 inches in diameter. The frame is of special design. As will be seen from the illustration, the table on which the indexing mechanism is mounted is an integral part of the frame. The ram guides are unusually long, and are adjustable.

A positive circulating oil system inside the frame insures the lubrication essential for such a high-speed press. All important moving members are mounted in ball or bronze bearings. Rotating movements actuate the indexing mechanism. The length of feed is easily adjusted to suit different numbers of notches.

When the foot-treadle is depressed, two movements take place: First, the spring on top of the circular table is drawn downward so as to hold the disk to be notched firmly to the table; and, second, the indexing mechanism is set in motion. Upon the completion of the cycle, the indexing mechanism stops automatically, the spring clamp is released, and the notched disk can be quickly removed. The foot-treadle is prevented from flying up and injuring the operator.

An attachment can be provided for notching stator laminations as well as laminations for rotors. Machines can also be supplied for notching segments, in which case the table has an automatic return. The motor can be arranged to drive either through V- or flat belts. A variable-speed motor or a constant-speed motor and a speed change-box can be supplied.

Taylor-Winfield Multiple-Projection Spot Welder

A heavy-duty projection welder capable of making a large number of welds at one time is shown in the accompanying illustration. This machine belongs to an EX Series, which is being introduced to the trade by the Taylor-Winfield Corporation, Warren, Ohio. The transformer is of the pancake design, with water-cooled secondaries, and it is so mounted that inductance losses are reduced to a minimum. The machine can be furnished with transformer capacities of 200, 250, 300, 350, 400, or 450 kilovolt-amperes, and with throat depths of 18, 24, 30, and 36 inches.

A nine-step self-controlled heat regulator, mounted on the side of the machine, gives a wide range of adjustments to suit various thicknesses of stock. Wide terminals provide ample space for supporting the welding dies. The lower knee has a vertical adjustment of 10 inches. It is supported at the outer end by heavy adjustable braces that eliminate deflection.

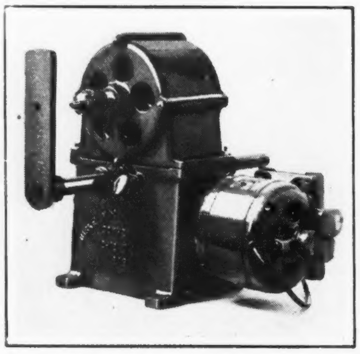
Any desired operating speed from 7 to 54 strokes per minute can be obtained by turning a handle on the side of the frame. The drive from the motor is delivered through an infinitely variable speed drive which gives a 3 to 1 variation. By merely reversing a pair of pick-off gears, the machine can be stepped up to the high-speed range that would be used only when work-

ing at a short stroke and on light-gage metal. Through a stroke-changing device built into the welder, any stroke between 1 and 2 3/4 inches can be obtained.

Any pressure up to 8000 pounds may be applied to the welding slide. The pressure is applied by a cam working through a toggle that is directly in line with the center of the slide. The pressure spring is also directly in line with the center of the slide, above the toggle, and is accessible for adjustment. The welder is equipped with a "Flexo-Mechanical" clutch control which consists of a foot-pedal connected by a flexible cable. This pedal can be readily moved to any convenient location.

Burke Motor-Driven Tapping Machine

The motor-driven bench-type tapping machine here illustrated is being placed on the market by the Burke Machine Tool Co., 516 Sandusky St., Conneaut, Ohio. Power is transmitted from the motor to the tapping spindle through an endless belt and a cork cone clutch. The motor mounting provides a wide range of belt take-up.



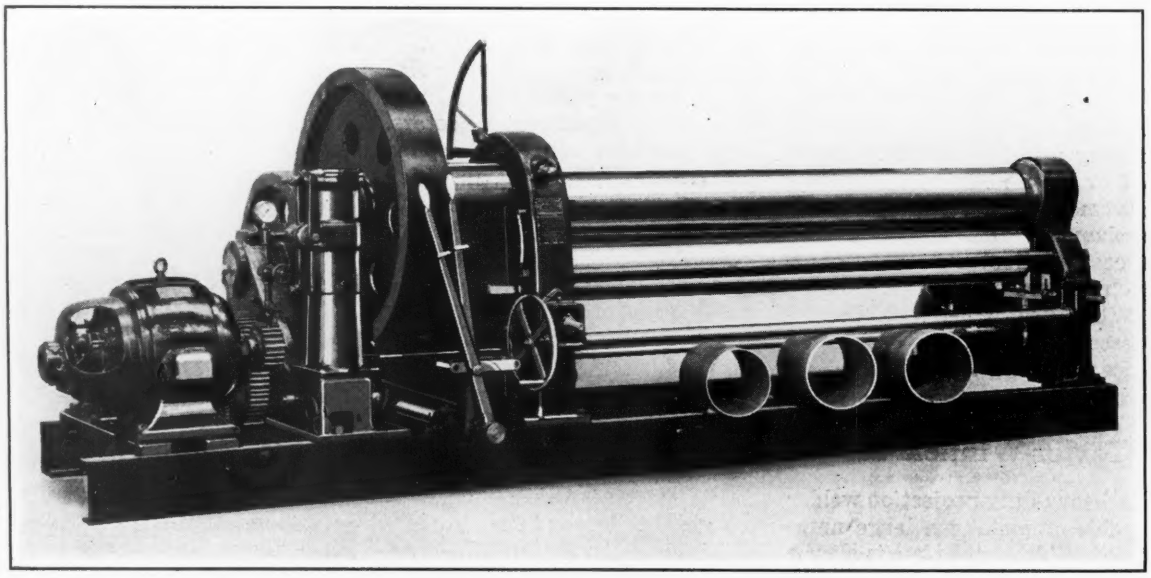
Burke Tapping Machine with Friction Drive

This machine is intended for tapping holes up to 3/8 inch in cast iron and up to 5/16 inch in steel. Taps can be driven to the bottom of blind holes without danger of breaking them. The friction wheel is of light construction, and is unusually sensitive on the reverse action. Both hands of the operator are free at all times for handling work. The faceplate has a movement of 10 inches. This machine weighs about 100 pounds.

Schatz Unilateral Plate-Bending Roll

The principal feature of a new type of plate-bending roll built by the Schatz Mfg. Co., Poughkeepsie, N. Y., is that it eliminates, as far as necessary in actual practice, the usual flat surfaces at the plate ends. The illustration shows a machine of this type for rolling plate up to 8 feet 4 inches wide by 1/2 inch thick to a diameter of 13 3/4 inches. The three rolls are made of forged steel having a tensile strength of about 140,000 pounds per square inch. The two front rolls are so arranged that the center line of the top roll lies somewhat behind that of the lower roll. The actual bending of cylinders or cones is accomplished by the adjustable rear roll. All three rolls are 10 5/8 inches in diameter and operate at a speed that provides a plate travel of about 25 feet per minute. The machine is driven by a 20-horsepower motor, and weighs about 20,000 pounds.

Machines of this type are built in various sizes for bending plates from 41 inches to 20 feet wide, and of various thicknesses. On the small and medium size machines, the lower front roll is raised and lowered by means of a conveniently located handwheel so as to pinch the plate. A graduated scale on the left-hand housing indicates the amount that the lower front roll should be adjusted for a predetermined plate thickness. A second graduated scale indicates the setting of the rear bending roll. These



Schatz Plate-bending Roll with Air Cylinder for Opening and Closing the Drop-end Bearing

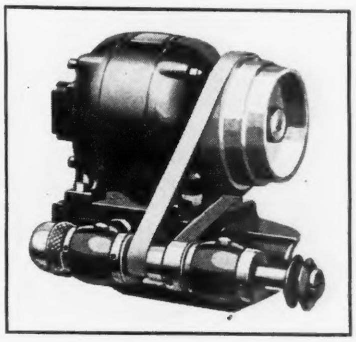
scales make it possible to determine what the roll settings should be for bending plate of given thicknesses to desired radii.

The machine illustrated is equipped with an air cylinder controlled by means of a lever near the station of the operator. A movement of this lever to the left causes the drop-end bearing to open, and at the same time, tilts the top roll upward sufficiently to permit easy withdrawal of the finished cylinder or cone. Another movement of the lever to the extreme right causes the top roll to drop into its former position and the drop-end bearing to close.

This machine is driven by one non-reversing motor. Reversal of the rolls is obtained by means of enclosed clutches, and the adjustment of the rear bending roll is effected by a multiple-disk friction clutch.

Five-Speed Layth-Grindar

In April MACHINERY, page 647, was published a description of a grinding attachment made by the Layth-Grindar Corporation, 28 Canfield St., Orange, N. J., in 1/20- and 1/30-horsepower sizes, for application to bench lathes. Since then, the concern has developed five additional sizes, ranging from 1/8 to 1 horsepower in capacity for use on engine lathes.



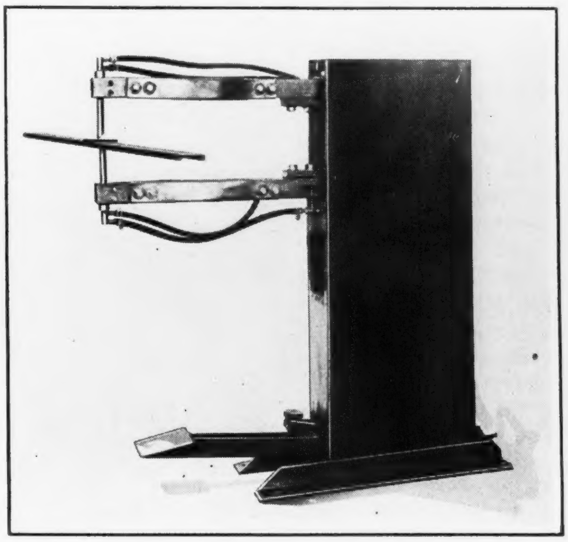
"Layth-Grindar" with Three-step Pulleys that Give Five Speeds

The 1/8-, 1/4-, and 1/2-horsepower sizes are equipped with three-step cone pulleys, which give three spindle speeds without changing the pulleys. By reversing the spindle pulley, two additional speeds are obtainable. For instance, on the 1/4-horsepower unit illustrated, speeds of 4200, 5300, 6000, 7250, and 9000 R.P.M. are available. This range enables the proper grinding speeds to be used as the wheel diameter is reduced by wear.

Spot Welder with Spring Arms

The Electric Arc Cutting & Welding Co., 160 Jelliff Ave., Newark, N. J., has recently built a special spot welding machine which permits the electrodes to move a short distance with the continuously fed pieces that are being welded together. At the end of their horizontal movement, the electrodes snap back into position for the next weld, and again move with the material as before. With this design, the continuous moving production line is not held up by the welding operation.

The swinging movement is obtained through the use of spring arms instead of solid arms. The sidewise movement of the electrodes is from 3 to 4 inches, but could be increased with longer arms. Either foot or automatic control of the operation can be provided.



Spot Welder with Swinging Arms that Permit Continuous and Automatic Operation

Grinder and Grinding Attachments

The United States Electrical Tool Co., 2477 W. 6th St., Cincinnati, Ohio, is introducing on the market a smaller model of the variable-speed grinder built by this concern. This Model 64 grinder, which is shown in Fig. 1, is regularly built in four sizes to accommodate 12- by 2-inch, 14- by 3-inch, 18- by 2-inch, and 20- by 2-inch wheels. The different sizes are intended for operation on alternating current of 220, 440, or 550 volts, 25, 30, 40,

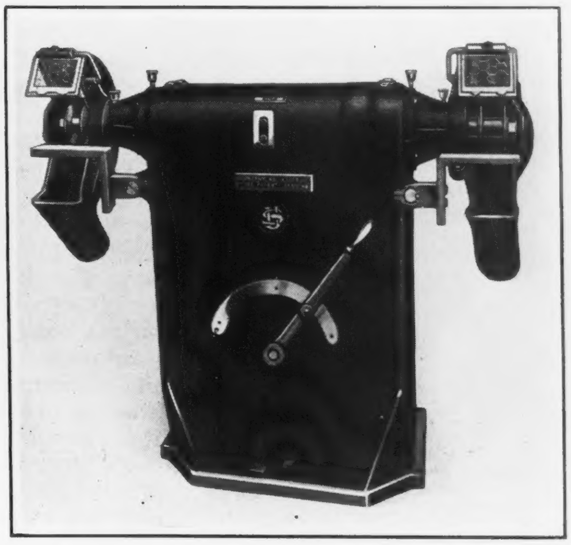


Fig. 1. Variable-speed Grinder Made by the United States Electrical Tool Co.

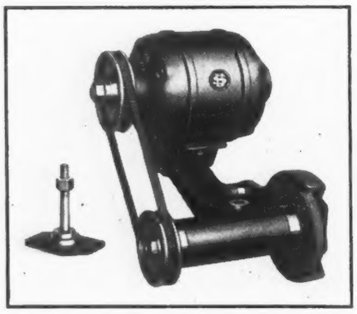


Fig. 2. Lathe Grinder for Use on Reamers, Dies, and Similar Parts

50, and 60 cycles, and either two or three phase.

The feature of the grinder lies in its ability to maintain a constant wheel surface speed, regardless of wear, which makes it possible to use the wheels down to the flanges. The constant speed is obtained by means of the patented Gibbs V-disk transmission of graphitized Micarta.

The same concern has also developed the grinding attachment shown in Fig. 2, which is intended for use on lathes of 9-inch swing and up, provided they are equipped with a compound rest. It is especially applicable for grinding centers, reamers, dies, rolls, shafts, and similar parts. It can also be used on shapers, planers, and boring mills. This grinding attachment is driven by a motor of 1/4 horsepower, having a speed of 5200 revolutions per minute. The motor is designed for operation on 110- or 220-volt alternating or direct current.

Another recent development of the United States Electrical Tool Co.'s is the brake drum grinder shown in Fig. 3, which can also be used on a lathe for grinding centers, reamers, dies, etc. When used on shapers, planers, and boring mills, it is suitable for handling many internal grinding jobs. This grinder is furnished in two sizes, one having a 1/2-horsepower motor running at a speed of 7000 revolutions per minute, and the other, a 1-horsepower motor running at a speed of 5200 revolutions per minute. Both models are built for either alternating or direct current.

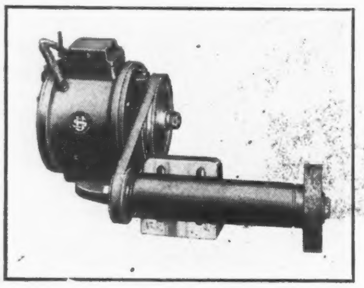


Fig. 3. Attachment for Both External and Internal Grinding

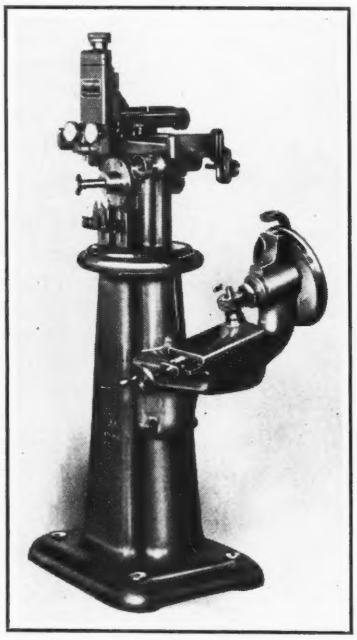


Fig. 1. Gear Checking Machine with Helix-angle Inspecting Device

National-Cleveland Angular Checking Device for Helical Gears

The helix angle of helical gears can be inspected by means of an angular checking device developed by the National Tool Co. W. 112th St. and Madison Ave., Cleveland, Ohio. This device is shown in Fig. 1 mounted on the pedestal of the Model B gear checking machine built by the concern, but it can also be attached to the Model C machine. It is also made as a separate unit —for example, as a bench type of measuring machine or as a unit for mounting on its own pedestal stand.

The helical gear to be tested is mounted, as shown in Fig. 1, on a stub shaft carried by a slide which is adjustable for engaging the teeth of the helical gear with the teeth of a rack mounted on a spindle that is at right angles to the stub shaft on which the gear is placed. This rack corresponds to the normal pitch and other tooth elements of the gear to be tested. The rack spindle can be swiveled in order to mate the rack properly with the gear teeth.

The reading of an angle thus established is taken direct from the large-diameter drum mounted on the same shaft as the rack. This drum is graduated in degrees and there is a vernier that gives readings in minutes. The operator can determine the helix angle of a gear quickly by reading the vernier through the magnifying glass that is furnished as part of the regular equipment.

Right- or left-hand helical gears can be checked quickly. When the device is mounted on its own pedestal stand, it can be placed in the line of production for 100 per cent inspection of helical gears. While the gear slide illustrated is adjustable by means of a screw and nut, these may be replaced by a spring-actuated lever for quick operation on production work. It will be obvious that the gears being inspected need not be clamped to the stub shaft.

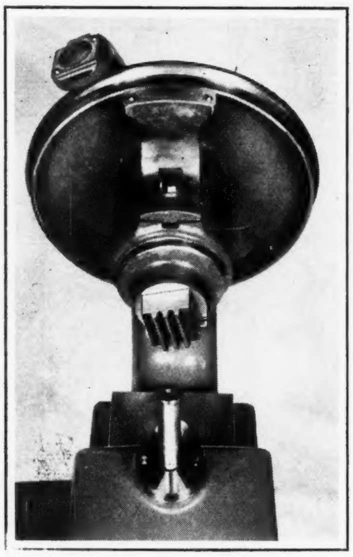


Fig. 2. The Angular Checking Device for Helical Gears

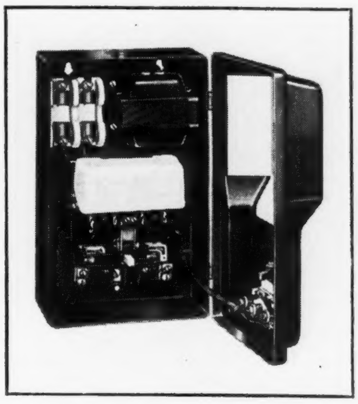


Fig. 1. Across-the-line Motor Switch with Low-voltage Control Circuit

Allen-Bradley Switches and Controllers

Alternating-current, across-the-line motor starting switches manufactured by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis., are now available with a step-down control transformer for reducing the control-circuit voltage to 110 volts when the switch is used on 440- or 550-volt circuits. The motor is protected against sustained overloads by means of two Resisto-therm overload relays, which can be reset from outside the cabinet.

This type of switch, which is shown in Fig. 1, is known as the Bulletin 709T across-the-line starting switch. It is used principally where the pilot control device, such as a pressure switch, thermostat or push-button, is limited to low-voltage application. The maximum rating of the switch is 7 1/2 horsepower.

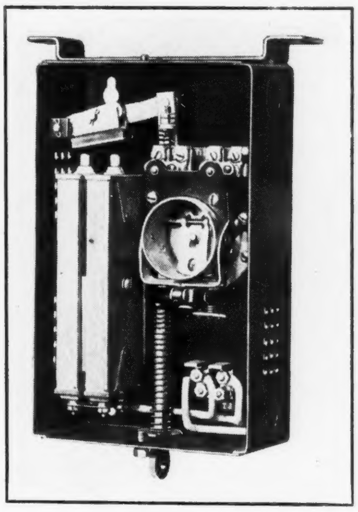


Fig. 2. Treadle-operated Controller for Small Motors

Fig. 2 shows a Bulletin 500 treadle-operated controller recently brought out to provide a smooth speed control for sewing machines, small tools, winding machines, etc., driven by direct current or universal motors. The operation of the treadle compresses a graphite disk resistor. This resistor allows a stepless variation in motor speed, and permits the operator to obtain the exact speed that best suits the nature of the work. The controller is made in five sizes, the largest being rated at 1/2 horsepower and the smallest at 1/20 horsepower.

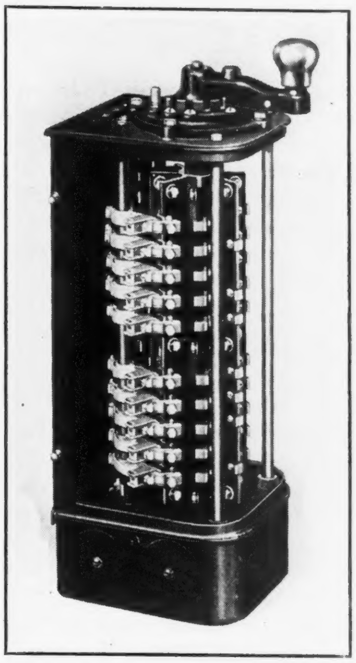


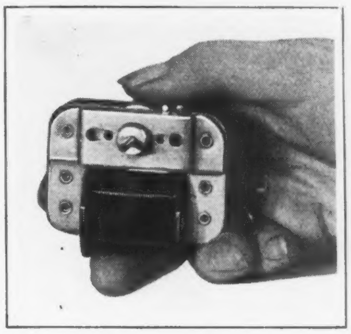
Fig. 3. Allen-Bradley Drum Controller for Multi-speed Motors

The same concern has also brought out a line of Bulletin 365 multi-speed drum controllers intended for reversing and non-reversing service with motors of two, three or four speeds. The motor may be of either the separate-winding or consequent-pole-winding type, and for variable-torque, constant-torque, or constant-horsepower applications. This controller is shown in Fig. 3. It is made in a range of sizes sufficient to take care of two- and three-phase motors up to 30 horsepower, using 220-volt current, and motors up to 60 horsepower, using 440- or 550-volt current.

Other new products include a line of drum reverse switches, designated as Bulletin 350, which are intended for across-the-line reversing of alternating- and direct-current motors, and for reversing service in connection with magnetic starters. Bulletin 715 automatic multi-speed across-the-line switches have also been developed for two-, three-, or four-speed non-reversing service in connection with two- and three-phase multi-speed motors of consequent-pole-winding or separate-winding types. Complete protection against overloads is provided through the use of thermal overload relays for each speed.

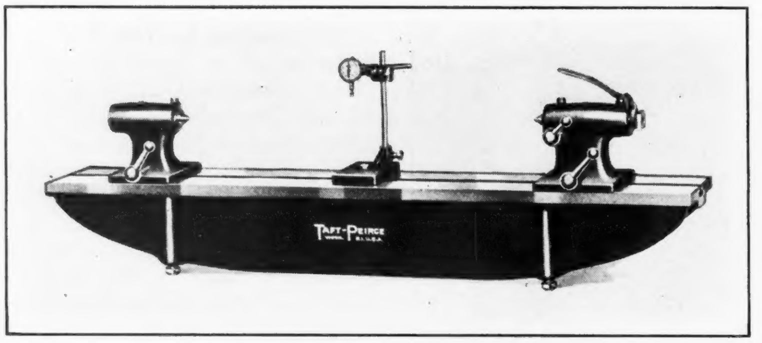
Barcol Small-Size Alternating-Current Motor

A fractional-horsepower electric motor smaller than the palm of the hand is being placed on the market by the Barber-Colman Co., Rockford, Ill. This motor is intended for use on electric fans, heat regulators, moving-picture projectors, etc., and for other applications where a high starting torque and small size are desirable. The principal advantage claimed for this motor is an unusually high power output for so small a size.



Barcol Small Alternating-current Motor

The motor is constructed of steel laminations, brass bearing plates with oilless bearings, and a squirrel-cage rotor mounted on a hardened shaft. All coils are wound on phenolic resin spools and are impregnated to exclude moisture and insure good insulation. The motor is made for any voltage between 10 and 230, and for alternating current frequencies from 25 to 60 cycles. Special two-speed models can be furnished.

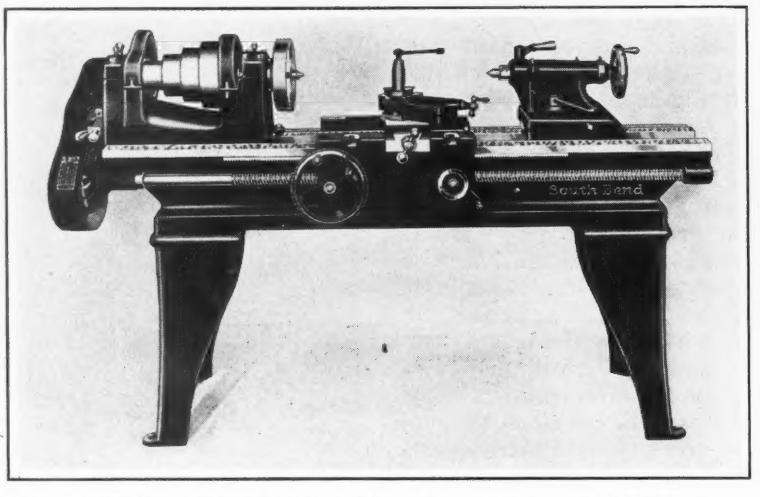


Taft-Peirce Bench Centers of Improved Design

South Bend Lathe of Simplified Design

The 16-inch general-purpose lathe now being placed on the market by the South Bend Lathe Works, 729 E. Madison St., South Bend, Ind., differs from conventional designs in that the friction feeds, both longitudinal and cross, are omitted. Automatic longitudinal feed is available for turning or thread-cutting operations by engaging the half-nuts with the lead-screw by means of a lever on the apron. The carriage is also fed longitudinally by means of a handwheel, and the cross-slide is operated by a ball-crank handle.

This simplified design provides an inexpensive machine for use in shops that do not require all the features of standard engine lathes. The lathe is built from the same units as the regular line of machines made by the concern. It is provided with independent change-gears for threads and feeds; a back-geared headstock having eight spindle speeds; a hollow spindle of alloy steel; a spring latch reverse for feeds and threads; a graduated compound rest; and a tailstock set-over for taper turning. This lathe is available in bed lengths of from 6 to 12 feet.



South Bend Lathe for Light Manufacturing, General Machine Shop, or Maintenance Work

Taft-Peirce Improved Bench Centers

The Taft-Peirce Mfg. Co., Woonsocket, R. I., has recently placed in production the improved bench centers here illustrated, which were originally designed for use in the inspection department of that concern. The maximum length between centers is 36 inches, and the swing over the bed, 8 inches.

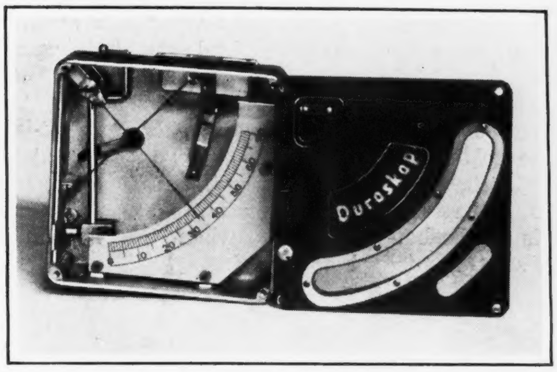
The bed is constructed of seasoned, close-grained cast iron, and its working surface is finish-ground. An accurate T-slot and suitable keys align the headstock and the tailstock and provide means of clamping them in position. Adjustable hardened studs at the four corners of the bed provide a method of leveling the bed without the use of shims.

The headstock and tailstock centers are made of hardened and ground tool steel. The headstock center is fixed, while the tailstock center is movable by means of a lever that swings over the top of the tailstock.

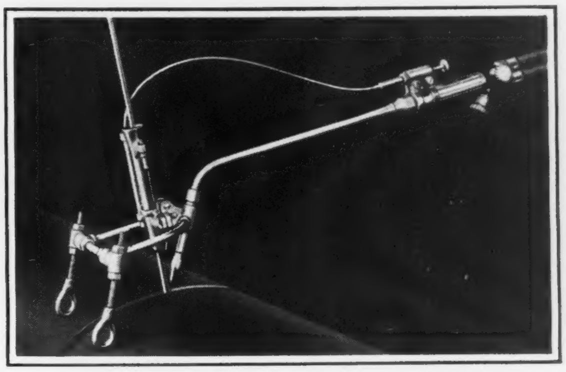
Portable Hardness Tester

A portable hardness tester that incorporates the principle of a falling pendulum is being placed on the market in the United States and Canada by the R. Y. Ferner Co., 1127 Investment Bldg., Washington, D. C. Tests can be made rapidly with this instrument, which is called the "Duroskop," since the procedure consists merely of holding it against the piece to be tested and pressing a button on the back of the case to release the pendulum. As the pendulum falls, it strikes against the work through a hole in the edge of the case. In rebounding according to the hardness of the piece, the pendulum carries with it a pointer, which remains at the highest position on the scale to which the pendulum rises.

The pointer is prevented from shifting by a wire stretched across it, which presses down on it slightly and causes it to rest against the edge of the scale over



"Duroskop" Hardness Tester which is Held by Hand against the Work



"Lindewelder"—an Oxy-acetylene Welding Blowpipe with a Carriage Support

which it moves. After a reading has been made with the instrument, the pendulum is returned to its upper position by means of a spring-actuated lever, and held there by a leaf spring, ready for the next test. In being raised to this position, the pendulum carries the pointer to the upper end of the scale. However, the pointer can be quickly brought back to the zero position by a lever on the front of the case.

An advantage of this instrument is that it does not mar the surface tested, it usually being necessary to use a magnifying glass in order to detect the point at which the blow was struck. Because of this, the instrument can be used in testing ceramics and other materials, as well as metals. It has been used on material less than 0.002 inch thick. It weighs less than 13 ounces, and will slip into a coat pocket.

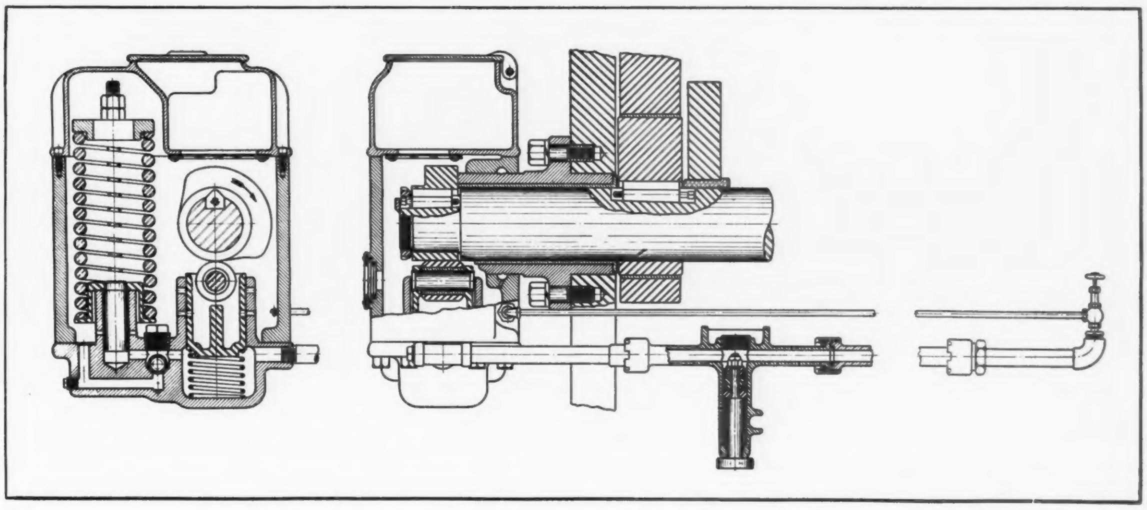
"Lindewelder"

An oxy-acetylene two-flame welding blowpipe having a welding rod holder that automatically feeds the rod by gravity is being placed on the market by the Linde Air Products Co., 30 E. 42nd St., New York City. This blowpipe is known as the "Oxweld Type W-21 Lindewelder." A rod lifting device controlled by a trigger on the blowpipe handle permits the operator to raise or lower the welding rod, as required, in starting and completing the weld, passing over tack welds, and changing the rod. During the welding operation, the blowpipe is supported by a carriage having two adjustable runners. The operator need use only one hand to hold the blowpipe.

Two separate flames are used —one for preheating the welding rod, and the other for preparing the base metal for proper fusion and for melting the end of the preheated rod.

Hydraulic Hold-Downs on Cincinnati All-Steel Shears

The all-steel squaring and slitting shears developed by the Cincinnati Shaper Co., Cincinnati, Ohio, which were described in November MACHINERY, are equipped with hydraulic hold-downs for clamping the steel sheet during the cut. These hold-downs are actuated by a cam on the end of the eccentric shaft, which actuates a piston that displaces oil in a master cylinder and forces the oil to the hold-down plungers. The oil pressure is regulated by a spring accumulator which also acts as a relief



Hydraulic Hold-down Mechanism of Cincinnati All-steel Squaring and Slitting Shears

valve. Each plunger delivers the same pressure, regardless of its downward travel. Thus, if a sheet varies in thickness, the low points will be clamped with the same pressure as the high points; or if two operators are working side by side simultaneously cutting short pieces of stock of different gages, the hold-downs will grip the pieces with the same clamping pressure.

The cam that actuates the piston is so designed that the instant the knife bar completes its downward travel, the piston is allowed to rise, the oil pressure drops, and the plungers are immediately retracted by springs. This feature makes the operation of the hold-downs independent of the upper knife, so that the sheet is released and the operator can prepare for the next cut while the knife is still traveling upward.

The accumulator can be regulated, by simply adjusting two nuts, to deliver different pressures to the hold-downs. This is important, since the pressure used to clamp a hard sheet will mark a softer one. Each plunger delivers a maximum of 2000 pounds pressure, making a total of 24,000 pounds available for clamping a twelve-foot sheet. Such a pressure prevents the sheet from slipping during a cut.

The heavy pressures make it possible to place the hold-downs close to the cutting edge of the knives without having the sheet tilt. This prevents waste and makes it possible to cut narrow strips. On smaller sizes of shears, the plungers are 5/8 inch from the edge; on others, 7/8 inch.

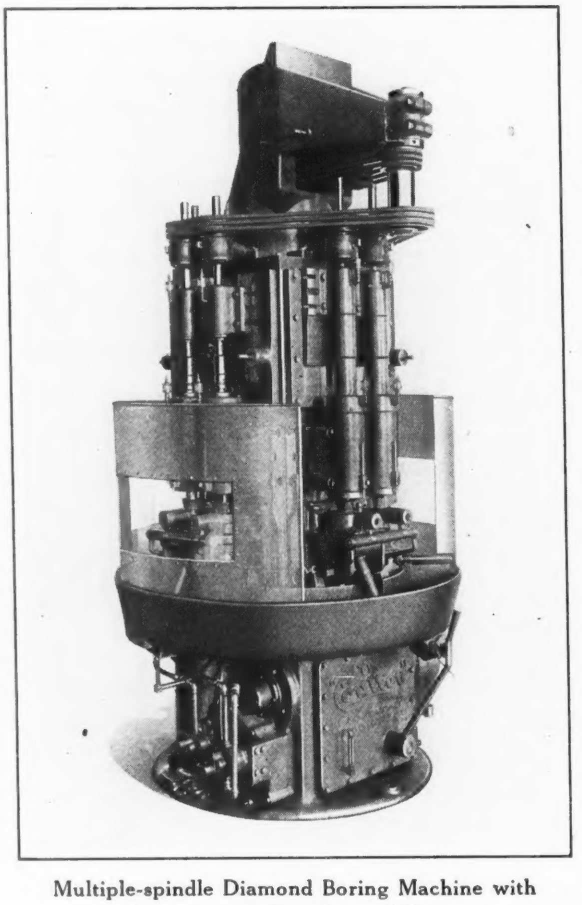
The hold-down bar is stationary, only the hold-down plungers moving to clamp the sheet. This is an important feature that contributes to the speed of the shear, since, being relatively light weight, the plungers can be moved fast without marking the sheets or the table. The 3/16-inch, 12-foot shear, for example, operates at the rate of 60 strokes a minute. Thus, the hold-downs must start down, hold the sheet while the knife cuts, and release it when the knife is at the bottom, all in one-half second.

Each hold-down is a separate assembly and can be removed from the machine without disturbing the other units. The plungers are placed at 12-inch intervals. The valve seen at the right in the illustration is opened to allow air to escape to the reservoir when the system is being filled.

Coulter Multiple-Spindle Diamond-Tool Continuous Boring Machine

A wide range of parts, including connecting-rods, pistons, bushings, magneto housings, pump bodies, and motor-end shields can be rapidly finish-bored in a Coulter multiple-spindle diamond-tool continuous boring machine recently developed by the Automatic Machine Co., Bridgeport, Conn. This machine was designed primarily for high production, and is automatic, except for loading and unloading.

The machine as illustrated is equipped for boring the wrist-pin and crankpin holes of connecting-rods. The production obtained is 4800 rods in an eight-hour day. Four identical fixtures with corresponding spindles, each carrying a boring-bar, are assembled on a continuously rotating column. Each spindle rotates at 4300 revolutions per minute and is given a vertical movement up and down for each revolution of the column. The spindles have micrometer adjustments and may be provided with ball bearings.



Multiple-spindle Diamond Boring Machine with Continuously Revolving Column

The vertical spindle movements are obtained by means of a stationary cam, the contour of which is such that each spindle is successively fed down rapidly to the work and then slowed up to rough-bore the hole. A fine finish is imparted to the bore as the spindle is returned upward at a slow feed. The second cut also eliminates any eccentricity in the bore, which might result from the springing of the boring-bar during the roughing cut. Incidentally, in boring wrist-pin holes in pistons, the spindle cam can be designed to feed the boring tools at a rapid rate across the gap between the tandem holes.

There is only one lever on the machine, and that is for starting and stopping at the beginning and end of each run. However, provision is made for rotating the

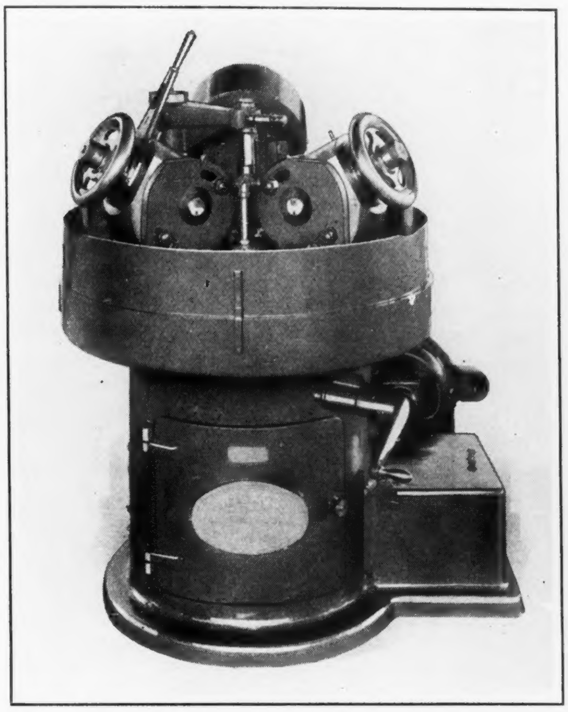


Fig. 1. Wicaco Bevel-pinion Burnishing Machine Having Three Master Gears

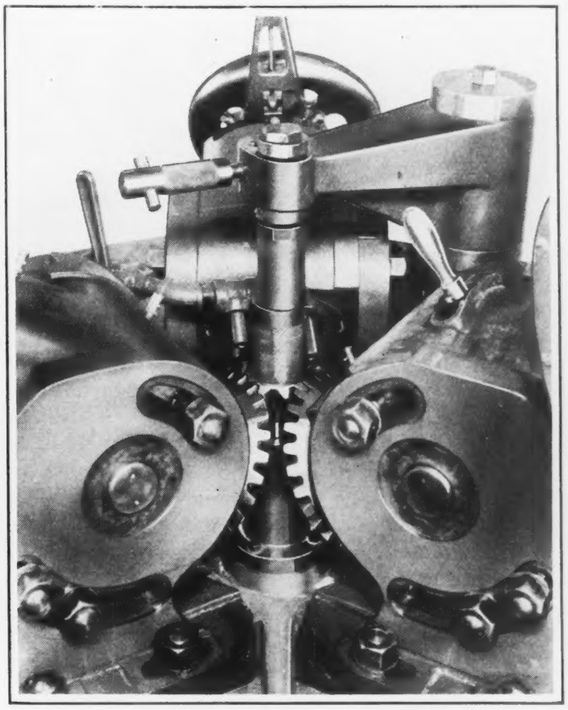


Fig. 2. Close-up View of a Burnishing Operation on a Spiral-bevel Pinion

column and raising the spindle by hand when setting up.

Coolant is pumped to each boring-bar that is cutting, a special device being provided to cut off the flow at the fixture being reloaded. Clamping and unclamping are accomplished automatically by cams. Power is delivered to the spindles from a 15-horsepower motor at the top of the machine by means of endless V-belts, and to the column through gearing. The grooved pulleys on the spindles of the fixture at the reloading station are disengaged from the belts, thus stopping the rotation of the boring-bars and contributing to the safety of the operator.

When two kinds of metal are being bored, as in the case of the connecting-rods, which have bronze and babbitt bearings, the two kinds of chips are washed down into separate compartments which encircle the machine. To prevent the accumulation of chips in these compartments, wipers attached to the revolving column constantly push the chips to the rear of the machine where they are allowed to drop into containers. Speed of production, with accuracy and quality of finish; sturdy design, combined with small floor space; and ease of operation, with centralized control are the principal advantages of the machine. It weighs about 12,000 pounds and is 9 feet 10 inches high. It is stated that on machines of this type as many as 50,000 holes have been bored without redressing the diamonds.

Wicaco Bevel-Pinion Burnishing Machine

Three master gears are revolved in engagement with the pinion being burnished, in a machine recently developed by the Wicaco Machine Corporation, 4801 Stenton Ave., Philadelphia, Pa., for burnishing all types of bevel pinions. The illustrations show this machine arranged for handling pinions of the spiral-bevel type. One of the master gears is belt-driven from a countershaft, and can be rotated in both directions. The other two master gears are mounted on spindles within micrometer sleeves and also conical eccentric sleeves. The axes of the three master gears and that of the pinion being burnished, intersect at one point. Thus, by placing the pinion between the three master gears, the pinion is allowed to find its own natural running position.

One of the eccentric sleeves has a hand-lever by means of which two master gears may be rolled about the common apex point. The construction enables a uniform tooth pressure to be imparted to all three master gears and to the pinion being burnished, and this pressure is in line with the common apex point of the four gears. The result is a swaging effect which tends to close the open pores of the metal grain and produce hard, glazed surfaces on the tooth profiles of the pinion. The bronze micrometer sleeves permit fine adjustments to and from the apex point.

The head that holds the driving master gear is also provided with a micrometer adjustment sleeve. The other two heads have

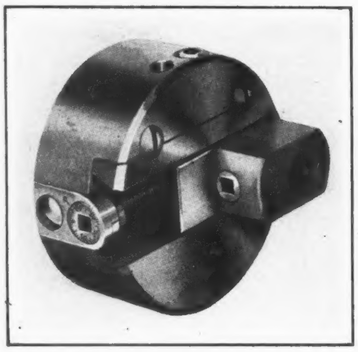
flywheels at the rear for balancing the heads on their shafts. All three heads are assembled in a trunnion bracket. They may be adjusted to the required angular positions to suit pinions of different gear ratios. Verniers permit accurate settings.

The overhead support arm is approximately located on the vertical column. It is provided with a micrometer stop, against which the slight upward thrust of the pinion is taken. Tests have shown that since the pinion being burnished is both driven and driving, the greatest part of the spiral thrust is counteracted, so that the thrust amounts to less than 2 per cent of the applied tooth pressure. Through a sleeve adapter, a fixed distance is established between the pinion shoulder and the stop. The location of the small end of the pinion is of little importance.

The machine is supplied with a pressure-feed system for delivering the lubricant to the pinion. A mixture of red lead, soda, and water is used. In order to obtain a satisfactory finish, it is recommended by the manufacturer that the speed of the machine should not exceed 225 revolutions per minute. The machine weighs approximately 3340 pounds, being of heavy and rigid construction so as to overcome all vibration.

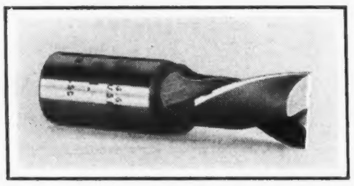
Flynn Micrometer Boring Head

A No. 30 boring head has been added to the line of Flynn micrometer boring heads sold by J. M. Waterston, 427 Woodward Ave., Detroit, Mich. This head is particularly adapted for use where a large offset is required, as the tool-holder can be offset 2 1/2 inches. The body is made of solid steel. It is provided with a dovetail to receive the tool-holder. A tension gib and a locking device take the strain from the micrometer screw.



Flynn Boring Head with Offset of 2 1/2 Inches

The screw dial is graduated in thousandths of an inch. For each complete turn of the screw, the tool-holder is moved horizontally 0.050 inch. This boring head receives bars from 1/4 to 3/4 inch. The diameter of the body is 4 1/2 inches, and the length is 1 3/4 inches.



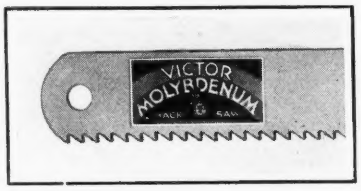
Brown & Sharpe Two-lipped End-mill with Straight Shank

Brown & Sharpe Straight-Shank Two-Lipped End-Mills

Two-lipped end-mills with spiral flutes and straight shanks are being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I., in seven sizes ranging from 1/4 to 3/4 inch in diameter, inclusive. The shanks are of the same diameter as the cutting edges. These end-mills are furnished in high-speed steel, and in both right- and left-hand styles.

Victor Molybdenum Steel Hacksaw

A heavy-duty hand and power hacksaw made of molybdenum steel is being introduced on the market by the Victor Saw Works, Inc., Middletown, N. Y. Engineers of this concern have been working for several years to develop a combination of heat-treatments and metals that would produce a hacksaw suitable for heavy-duty service. The results have enabled the new hacksaw to be brought out in celebration of the twenty-fifth anniversary of the concern.



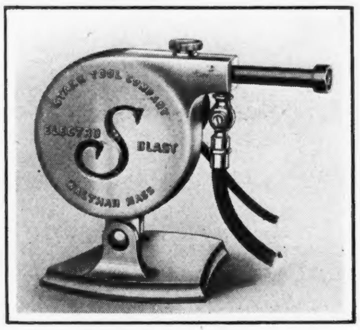
Heavy-duty Molybdenum Steel Hacksaw

"Electroblast" Blow-Torch

A self-contained gas blow-torch designed for heat-treating, soldering, light brazing, melting, and other operations requiring an intense heat from an inexpensive source has been placed on the market by the Stark Tool Co., Waltham, Mass. The blower of this torch is driven by a 1/16-horsepower universal motor, and hence, the device has been given the name of "Electroblast."

In the model illustrated, the motor and nozzle are mounted as a unit on a base that permits adjustments to any convenient angle. The blow-torch is also furnished in a model designed for hand use. In the latter design, the blower housing is made of aluminum and is provided with a pistol-grip handle.

The nozzle is designed to burn natural, manufactured, or tank gas. When firing against a refractory, temperatures of approximately 2700 degrees F. can be obtained. Any desired flame can be produced by simply adjusting the air and gas controls.

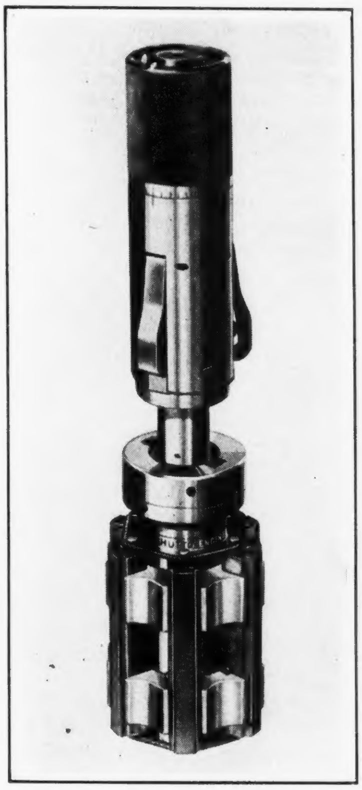


Gas Blow-torch with Motor-driven Blower

Automatic Drive-Head for Hutto Grinders

Automatic contraction and expansion of the grinder or hone made by the Hutto Engineering Co., Inc., 515 Lycaste Ave., Detroit, Mich., is possible with a drive-head that has just been developed by that concern. This device saves much time by eliminating the necessity of contracting and expanding the grinder manually. One major setting of the micrometer adjustment suffices for grinding all bores of the same diameter to equal limits. The only additional adjustment necessary is to compensate occasionally for abrasive wear.

All wearing parts of the drive-head are hardened and ground to give long life and minimum maintenance. Anti-friction bearings are provided throughout the adjusting mechanism. The drive-head embodies such features of the Hutto grinder as the full-floating mechanism which compensates for uneven stone wear; the rigid-type expansion medium; and the automatic stop control.



Hutto Grinder with Expanding and Contracting Drive-head

Explosion-Proof Across-the-Line Starter

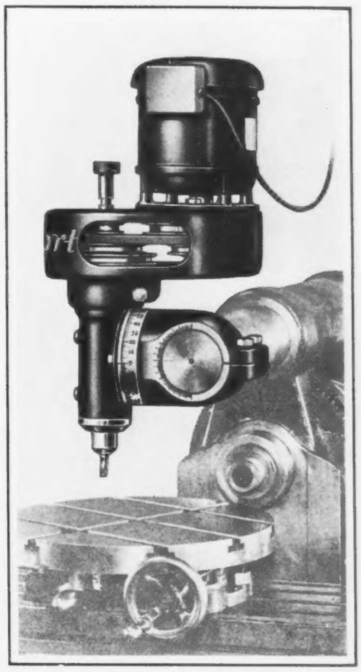
The motor starter here illustrated, which has been approved by the Underwriters for Class 1, Group D hazardous locations, has been placed on the market by the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. This starter is enclosed by a case that is tight enough to prevent the transmission of any flame from the inside of the case to the surrounding atmosphere.

Explosion-proof Starter for Electric Motors

The flanged joint between the upper and lower parts of the case is of sufficient length to cool any gases formed within, before they can come into contact with the surrounding atmosphere.

The contactor mechanism and overload relays are mounted on a slate base, which is removable from the case. The main contacts and the overload relay contacts are oil-immersed. All working parts are kept lubricated and protected from corrosion by capillary attraction of the oil. The terminals are located above the oil level. The maximum ratings of this starter are 5 horsepower, 110 volts; and 10 horsepower, 220, 440, and 550 volts.

Bridgeport High-Speed Milling Attachment



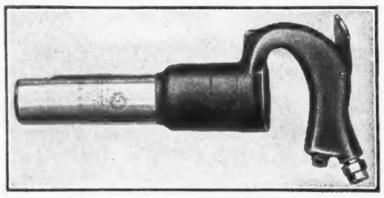
High-speed Milling Attachment for Application to Milling Machines

A high-speed milling attachment designed to be mounted on the over-arm of milling machines has been developed by the Bridgeport Pattern & Model Works, 50 Remer St., Bridgeport, Conn. This attachment provides for driving cutters at speeds of 500, 1300, 2500, and 5000 revolutions per minute. Power is transmitted to the spindle of the attachment by four-step aluminum pulleys with V-grooves that receive a molded endless belt. The motor is of 1/4-horsepower rating and runs at 1725 revolutions per minute. It is pivotally mounted to provide a convenient means of taking up belt slack. The motor operates in either direction to suit right- and left-hand cutters.

The spindle of this attachment accommodates draw-in collets having a maximum capacity of 7/16 inch. It runs in four ball bearings. The bearings on the pulley end float in the housing to compensate for expansion and contraction of the spindle. The combination belt guard and motor bracket swivels completely around the spindle housing, so that the head can be tilted both ways to any angle through 360 degrees.

Chicago Pneumatic Ring-Valve Chipping Hammers

Ring-valve chipping hammers with only five major parts are being placed on the market by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. The five parts consist of the cylinder, ring valve, piston, metal guard, and handle. The advantages claimed for this design, in addition to simplicity, are unusual power, cutting speed, and smoothness of action, as well as low maintenance costs.



Chipping Hammer with Only Five Major Parts

The valve is a simple band ring which is placed over the end of the cylinder and has a movement of only 1/64 to 1/32 inch, depending upon the size of the hammer. A locking device automatically tightens the handle. These hammers are made in five sizes, ranging in weight from 11 to 13 1/2 pounds, and in overall length from 11 3/4 to 15 1/2 inches. The smallest size strikes 2975 blows per minute, and the largest, 2240 blows per minute.

Obituaries

Carl A. Johnson

Carl A. Johnson, president of the Gisholt Machine Co., Madison, Wis., died suddenly on October 30 at the age of sixty-one. Mr. Johnson was one of the most prominent men in the machinery industry, and for the last two years was president of the National Machine Tool Builders Association.

Mr. Johnson was born in 1870, the son of John A. Johnson, who came to America from Norway in 1844, and who was one of the owners of the Fuller & Johnson Machine Co., and the organizer of the Gisholt Machine Co. In the shops of the latter company, Mr. Johnson obtained a thorough training for his life work. Upon graduating from the University of Wisconsin in 1891 with the degree of Bachelor of Mechanical Engineering, he became connected with the Gisholt Machine Co., of which he was later made president.

Mr. Johnson was unusually active in commercial and industrial enterprises as well as in public affairs. He was president of the Wisconsin Manufacturers' Association for seven years, and founder and first president of the Madison Association of Commerce. He was also a director of the United States Chamber of Commerce, and a director of the First National Bank in Chicago and of Cutler-Hammer, Inc., of Milwaukee.

Mr. Johnson was greatly interested in the University of Wisconsin, and was instrumental in bringing the industries

of the state into closer cooperation with the university. He not only believed in education, but he believed in helping young men to obtain one. The fact is not generally known that he financed several dozen young men's way through the university.

The machinery industry has lost one of its outstanding men in Mr. Johnson, and his sudden death will come as a shock to his many friends throughout the industry.

Louis G. Henes, president of the Henes-Morgan Machinery Co., Ltd., Los Angeles, and of the L. G. Henes Machinery Co., San Francisco, Calif., died suddenly from heart failure in New York City, November 1. Mr. Henes was a graduate of Columbia University, class of 1904. He went to the Pacific Coast in 1906 and founded the machinery business bearing his name. In 1915, he established branches in San Francisco and Los Angeles in association with Frank M. Morgan. He was a member of the American Society of Mechanical Engineers and was considered one of the outstanding machine tool authorities in the industrial west.

Leon C. Deckard, northern Pennsylvania representative of the Barney Machinery Co., Inc., Pittsburgh, Pa., died suddenly of heart failure Sunday, November 1. Mr. Deckard, who made his home at Erie, Pa., had been associated with the Barney Machinery Co. for the last six years.

News of the Industry

Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa., plans to increase its water meter production, and is contemplating the purchase of automatic chucking and screw machines to be used in the water meter department.

Dardelet Threadlock Corporation, 120 Broadway, New York City, has licensed the Automatic Products Co. and the National Machine Products Co., both of Detroit, Mich., to manufacture bolts and nuts, cap-screws, set-screws, and studs threaded with the Dardelet self-locking screw thread.

Pioneer Engineering & Mfg. Co., Inc., 8316 Woodward Ave., Detroit, Mich., manufacturer and distributor of Rollway coolant and lubricant pumps, Pioneer multiple-spindle drill heads, and Electro-Chemical copper patterns, has announced the signing of exclusive sales-agency contracts with nine companies located in important cities in the United States.

Cincinnati Milling Machine Co., Cincinnati, Ohio, recently was the host to 370 factory executives, engineers, and tool designers from Detroit, who journeyed from that city to visit the plants of the Cincinnati Milling Machine Co. and the Cincinnati Grinders, Inc. Fred A. Geier, president of the Cincinnati Milling Machine Co., gave an address at a dinner served in the company's dining room, reviewing the company's history during the last forty-seven years.

Geometric Tool Co., New Haven, Conn., announces the appointment of the

This Ground-Form Cutter

Sets a New Record on a Difficult Job

Form grinding gives the cutter the fine degree of accuracy required and insures increased production due to each tooth doing its share of cutting. Available for forms of comparatively simple nature.

The Cost of
Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

What Is the *Real* Cost of Your Cutters?

Eight inches of a Lynite Casting — one curved and two angular surfaces to mill — extreme accuracy a requisite — and a Brown & Sharpe Cutter is "out in front" with a substantial increase in production over the previous method of milling.

Oftentimes, as in this case, a special cutter, correctly conceived, designed and produced, will effect an economy in shop costs greater than would be imagined possible.

Whether stock or special, Brown & Sharpe Cutters give you the utmost cutter value. Send for Catalog No. 31 showing complete line of cutters. Or consult the Brown & Sharpe Dealers for your stock or special cutters. Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

Brown & Sharpe Cutters

MODERN — EFFICIENT — KEEP COSTS LOW

Ralph Leavenworth

Personals

T. D. KINGSLEY, formerly vice-president of S. F. Bowser & Co., Inc., has been appointed general sales manager of the Garwood Boiler Division of the Wood Hydraulic Hoist & Body Co., Detroit, Mich.

RALPH LEAVENWORTH has been appointed general advertising manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Previous to joining the Westinghouse organization, he was assistant general sales manager of the Austin Co. of Cleveland, and has had considerable other experience in advertising and sales work.

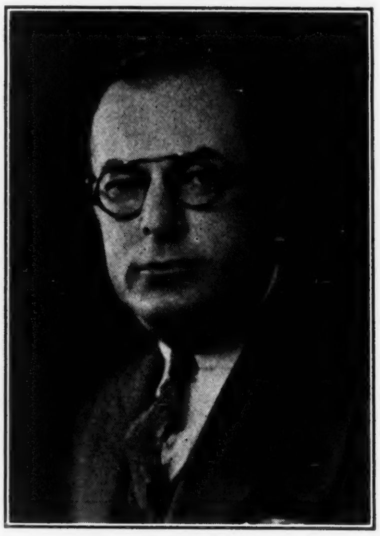
CLAUDE O. STREETER, well-known mechanical engineer in the power transmission field, has left New York City, where he was formerly engaged, and returned to his home in Shrewsbury, Mass. His plans for the immediate future have not yet been announced.

F. G. LYON has joined the sales organization of the J. B. Morrison Machinery Co., Toronto, which company is the Canadian representative of the Ex-Cell-O Aircraft & Tool Corporation of Detroit, Mich. Mr. Lyon's headquarters will be at 1549 Pelissier St., Windsor, Ontario, Canada.

O. A. AHLERS has been made purchasing agent of the City Machine & Tool Works, East Third and June Sts., Dayton, Ohio. Mr. Ahlers was formerly assistant secretary-treasurer and purchasing agent of the International Tool Co., and previous to that was with the City Machine & Tool Works organization, to which he has now returned.

L. U. MURRAY, district manager of the industrial department, east central district, of the General Electric Co., with headquarters at Cleveland, has been appointed manager of the Graybar-Western Electric department, with headquarters at Schenectady, N. Y. Mr. Murray succeeds the late R. S. Johnston. J. P. JONES, manager of the machinery manufacturers' section of the industrial department at Schenectady, has been appointed district manager of the industrial department, east central district, to succeed Mr. Murray. J. J. HUETHER will succeed Mr. Jones.

A. W. THOMPSON, for the last five years Pacific Coast manager in charge of sales for Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill., has been appointed vice-president in charge of manufacturing, succeeding Mr. Heath. Mr. Thompson has been associated with the company since 1920, and during all this period has maintained a close contact with the manufacturing activities of the company, particularly at Beloit, Wis., where he will make his headquarters. He is a graduate engineer, and has had wide experience both in engineering and sales work.

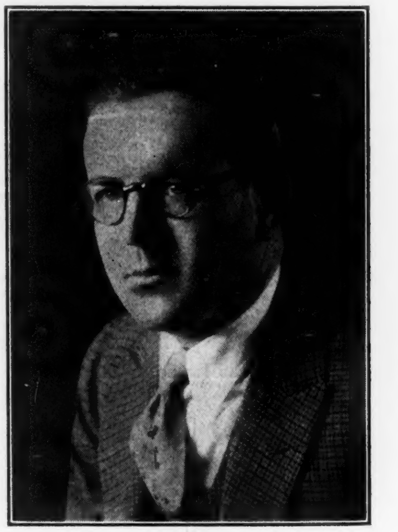


A. A. Probeck

A. A. PROBECK has been appointed sales manager of the Federal Machine & Welder Co., Warren, Ohio. Mr. Probeck started in the welding field in 1910 with the C. & C. Co., one of the first manufacturers of arc welders. In 1912, he joined the Federal Machine & Welder Co., and in 1917 returned to the arc-welding field. He renewed his association with the Federal organization on October 1.

H. P. RODGERS has been appointed representative in the Cleveland territory, with offices at 528 Leader Building, of the Duriron Co., Inc., Dayton, Ohio, manufacturer of acid-resistant metals.

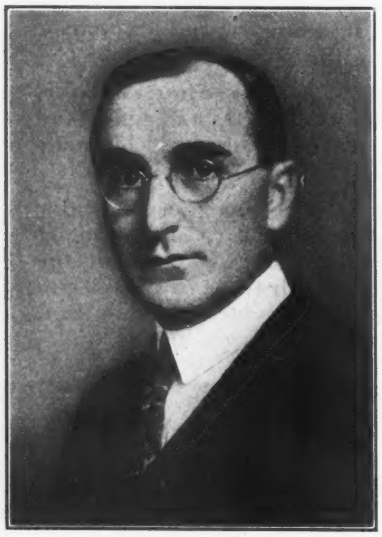
EUGENE F. LENOIR, formerly president and general sales manager of the Union Electric Mfg. Co., Milwaukee, Wis., has become associated with the Allen-Bradley Co., of Milwaukee. In his new capacity, Mr. LeNoir will have contact with motor manufacturers through the Allen-Bradley district offices and agents as a special representative.



Eugene F. LeNoir

Drake-Grau Tool & Mfg. Co., Ltd., 1520 E. Slauson Ave., Los Angeles, Calif., as exclusive agent for the sale of Geometric threading machines, die-heads, taps, and chasers in Southern California. C. W. Marwedel, 11th and Alice Sts., Oakland, Calif., handles Geometric products in Northern California, and J. C. Ross Co., 2719 First Ave., Seattle, Wash., is exclusive agent in Washington and Oregon.

YALE & TOWNE MFG. CO., Stamford, Conn., announces that the entire material-handling equipment department of the company is now concentrated at its new Philadelphia plant. In this plant will be manufactured the different types of material-handling equipment—hand and electric chain hoists, overhead conveying systems, and electric industrial trucks—that were formerly manufactured at Stamford, Conn., and the Stuebing line of hand-lift trucks formerly made at Cincinnati, Ohio, and Holyoke, Mass. The new Philadelphia plant has been especially planned to permit the economical production of a large volume of the types of equipment mentioned.



A. W Thompson

Coming Events

NOVEMBER 30-DECEMBER 4—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies' Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

DECEMBER 10—Meeting of the Steel Founders' Society of America at Hotel William Penn, Pittsburgh, Pa. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

DECEMBER 10-11—Seventh annual conference on welding to be held by the Engineering Extension Department of Purdue University at Lafayette, Ind.

JANUARY 21—Annual meeting of the Steel Founders' Society of America at Chicago, Ill. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

MARCH 7-12—Packaging, Packing, and Shipping Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. Exposition headquarters, Room 602, 225 W. 34th St., New York.

MAY 2-6—Thirty-sixth annual convention and exhibit of the American Foundrymen's Association to be held in the new Municipal Convention Hall, 34th St. and Vintage Ave., Philadelphia, Pa. Executive secretary, 222 W. Adams St., Chicago, Ill.

New Books and Publications

AMERICAN STANDARDS YEAR BOOK, 1931. 102 pages, 8 by 11 inches, listing all standardization projects completed or under way. Published by the American Standards Association, 29 W. 39th St., New York City.

EXAMPLES IN PLANE TRIGONOMETRY. By Winfield M. Sides. 72 pages, 5 by 7½ inches. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price, 70 cents.

This book of examples in plane trigonometry is designed to expand the field of the ordinary text-book. The examples are arranged under proper headings, with each group graded according to the degree of difficulty. Students of trigonometry will find the book a valuable aid in obtaining practice in solving trigonometrical problems.

THE BALANCING OF MACHINERY. By C. Norman Fletcher. 172 pages, 5½ by 8½ inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 10 shillings, net.

The high rotational speeds used in many types of machinery today make accurate balancing a matter that no engineer can afford to ignore. Heretofore, there has been little available material dealing with balancing from a practical or production standpoint. This volume has been written to supply engineers with information in a comparatively simple and practical form on the factors affecting balance, the better known balancing equipment now available, and methods and calculations involved in correcting unbalance.

DYNAMIC LOADS ON GEAR TEETH. 71 pages, 8 by 10½ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This book contains the complete report of the special research committee of the American Society of Mechanical Engineers that has been engaged in investigating the strength of gear teeth for the last six years. The investigation has been conducted at the Massachusetts Institute of Technology, Cambridge, Mass., by Earle Buckingham, associate professor of Engineering Standards and Measurement. Professor Buckingham has also prepared the report now published. This report is divided into eight chapters, each dealing with some particular phase of the subject. A great deal of test data is presented, together with information pertaining to the application of the results in practical machine design.

DIESEL REFERENCE GUIDE. By Julius Rosbloom. 300 pages, 8 by 10 inches; profusely illustrated. Published by the Industrial Institute, Inc., 901 Bergen Ave., Jersey City, N. J. Price, $10. Price includes a semi-annual supplement.

This book has been prepared to suit the needs of engineers interested in Diesel engines. It deals with the theory of these engines, the physical laws governing the action of gases, the principles of construction and operation of Diesel engines, instruments and accessories, oil purification, fuel oil, lubricating oils, pumps, air compressors, oil storage, and piping systems. It also contains a record of recent noteworthy Diesel-engine developments, including oil-electric locomotives and railroad cars, and automobile and aircraft Diesel engines. A great deal of statistical information, convenient tables for reference, and power cost data are included. An appendix lists manufacturing establishments, engineering firms, and commercial houses in the field of Diesel engineering and allied industries.

Societies, Schools and Colleges

GRAY IRON INSTITUTE, INC., Cleveland, Ohio. has moved its offices to 4300 Euclid Ave.

WORCESTER POLYTECHNIC INSTITUTE. Worcester. Mass. Catalogue for 1931-1932, containing calendar, outline of courses, and other information concerning the Institute.

New Catalogues and Circulars

OIL RETAINERS. Chicago Rawhide Mfg. Co., 1304 Elston Ave., Chicago, Ill. Circular outlining the features of the "Perfect" oil retainer.

ELECTRIC FURNACES. General Electric Co., Schenectady, N. Y. Catalogue showing various applications of GE electric heat treating furnaces.

PUMPS. Worthington Pump & Machinery Corporation, Harrison, N. J. Catalogue of power pumps of the horizontal-duplex-piston pattern, Type D-2437.

UNION SWITCH & SIGNAL CO., Swissvale, Pa., manufacturer of drop-forgings, is distributing a calendar for the year 1932, showing three months on each sheet.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-940B containing data on switchboard devices and panel and benchboard pipe fittings.

MOTORS. Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio. Bulletin 210, illustrating and describing Type T, two-pole Reliance motors for direct current.

METAL FINISHING. Metal Finishing Products Co., 3019 E. 61st St., Cleveland, Ohio. Folder entitled "The Care and Maintenance of Architectural Aluminum and Other Decorative Metals."

TUMBLING BARRELS. Baird Machine Co., Bridgeport, Conn. Leaflet supplementing Catalogue 300, containing description and specifications of the Baird Model A motor-driven oblique tilting tumblers.

FORM CUTTERS. Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin entitled "Production Increased—Accuracy Maintained," describing a job performed with Brown & Sharpe ground-form cutters.

AUTOMOTIVE EQUIPMENT. Sunnen Products Co., St. Louis, Mo. Leaflets descriptive of the Sunnen cylinder grinder, pin-hole grinder, and Junior model dry grinder for regrinding cylinders of small bore.

INDUSTRIAL TRUCKS. Yale & Towne Mfg. Co., Philadelphia, Pa. Folders descriptive of Stuebing Blue Streak trucks; Stuebing Red Streak trucks; Yale single-stroke lift trucks; and Yale multiple lift trucks.

PERMANENT MOLDS. Holley Permanent Mold Machine, Inc., Detroit, Mich. Bulletin entitled "A Modern Process Applied to an Ancient Art," descriptive of the Holley permanent mold process for producing castings.

WELDING MACHINES. Thomson-Gibb Electric Welding Co., Bay City, Mich. Circular illustrating and describing the Thomson-Gibb F13-60 flash welder. A number of applications of electric flash welding are illustrated.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular in the Hump and Homo Series, treating of the use of Homo furnaces for heat-treating non-ferrous metals and for nitriding.

SPEED REDUCERS. Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill. Circular entitled "Power Simplified," illustrating and describing the Janette motorized speed reducer—a compact unit combining a speed reducer and motor.

HOISTING AND CONVEYING EQUIPMENT. Wright Mfg. Co., Bridgeport, Conn. Condensed catalogue No. 15, covering hand-operated chain hoists, trolleys, trolley hoists, traveling cranes, jib cranes, and electric hoists.

PRECISION BORING MACHINES. Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. Bulletin illustrating and describing the details of construction of the new Ex-Cell-O double-end precision boring machine.

WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 24 in a series on "Elements of Design," treating of the application of bosses on framework, and the use of welding equipment for work of this kind.

FLEXIBLE COUPLINGS. T. B. Wood's Sons Co., Chambersburg, Pa. Leaflet entitled "Standardize on This Better Flexible Coupling," illustrating the Universal Giant Type B flexible coupling, which is designed to absorb shocks and strain.

VALVES. Homestead Valve Mfg. Co., Inc., Coraopolis, Pa. Reference book containing 48 pages of data on valves. Copies may be had upon request to headquarters, or to any of the representatives of the company located in the principal cities.

LATHES. South Bend Lathe Works, 729 E. Madison St., South Bend, Ind. Catalogue 92, giving dimensions, prices and other important data for the complete line of Series O South Bend lathes. Ninety-six different sizes and types of these lathes are shown.

DIEMAKING MACHINE. Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich. Circular describing the features and principle of operation of the improved Oliver diemaking machine. Illustrations and specifications for the various types are included.

Upset Steering Gear Sector Forgings . . .

by

THE DETROIT FORGING COMPANY

DETROIT, MICH.

REALIZING the importance of safety in steering gear construction, many leading automobile and equipment manufacturers rely on The Detroit Forging Company for sector forgings of the highest quality.

Steering gear sector forgings by The Detroit Forging Company are made by the upset process which means a flawless product in which the metal is given a thorough working with a uniform, continuous fibre flow from shaft to teeth.

In meeting production requirements on this as well as other jobs, The Detroit Forging Company gives credit to the fine performance of the latest addition to their upsetting equipment—an AJAX Heavy Duty Upsetting Forging Machine.

THE AJAX MANUFACTURING CO.
EUCLID BRANCH P. O., CLEVELAND, O.
Chicago Office: 621 Marquette Bldg.

AJAX

COUNTERBORE SETS. Gairing Tool Co., Detroit, Mich. Circular illustrating the Gairing standard counterbore sets. Three sets are provided, containing different sizes of the three standard types of counterbores and spot-facing tools made by this concern.

MATERIAL - HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating applications of the Cleveland overhead tramrail system for moving commodities or products in the machine shop.

POWER-TRANSMITTING EQUIPMENT. Morse Chain Co., Ithaca, N. Y. Bulletin R 50, containing information on Morse roller chain drives, including data on designing chain drives. Dimensions and prices are given for Morse single, double, triple, and quadruple standard roller chain.

INDICATING, RECORDING AND CONTROLLING INSTRUMENTS. Brown Instrument Co., Philadelphia, Pa. Bulletin explaining and illustrating the principal features of the new Brown potentiometer pyrometer, with special reference to accuracy of operation and ruggedness in service.

HEAT-TREATING FURNACES. W. S. Rockwell Co., 50 Church St., New York City. Bulletin 318, descriptive of the Rockwell roller hearth furnace for the heat-treatment of ferrous and non-ferrous metals, tubes, bars, rods, sheets, coils, and miscellaneous forgings, castings, and stampings.

SELF-LOCKING SCREW THREADS. Dardelet Threadlock Corporation, 120 Broadway, New York City. Bulletin 7, entitled "The Answer to This Problem—Dardelet the Self-locking Screw Thread," describing the introduction of the Dardelet self-locking thread into sucker-rod joints.

GRINDING MACHINES. Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. Leaflets VHM-1 and SP3-A, illustrating and describing, respectively, Churchill precision grinding machines of the vertical spindle, plano type, and the Churchill triple truing method of spline-shaft grinding.

INVENTORY. Barrett Bindery Co., 1328 W. Monroe St., Chicago, Ill. Booklet entitled "How to Take Inventory in Manufacturing Plants," outlining methods that have proved satisfactory for this purpose, and showing forms and cards useful for doing this work. The booklet will be sent free upon request.

GEAR-BURNISHING MACHINES. City Machine & Tool Works, E. 3rd and June Sts., Dayton, Ohio. Circular illustrating and describing Bolender hydraulic and air-controlled gear-burnishing machines, which are built in four models, having capacities ranging from 1/4 inch to 24 inches outside diameter.

GRINDING MACHINES. Layth-Grindar Corporation, 28 Canfield St., Orange, N. J. Circular describing the features of construction of the "Layth-Grindar"—a precision grinder intended to be applied to engine and bench lathes in shops where there is not sufficient grinding work to justify the investment in a machine grinder.

MILLING MACHINES. Van Norman Machine Tool Co., Springfield, Mass. Bulletin 11, illustrating and describing the new No. 11 Van Norman duplex milling machine, which is especially adapted to handle the intricate angular and special milling jobs encountered in toolrooms, pattern shops, die shops, and experimental laboratories. Complete specifications of the machine are included.

CHAIN DRIVES. Link-Belt Co., 515 Holmes Ave., Indianapolis, Ind. Folder 1260, illustrating and describing what is said to be the world's smallest silent chain drive. The new chain drive is a 3/16-inch pitch silent chain made in three types—middle guide, side flanged, and duplex. It is especially applicable to such equipment as phototone machines, power cameras, television apparatus, regulators, meters, and oil burners.

SEPARATOR MAGNETS. Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio. Bulletin 125, entitled "The Story of Ohio Separation Magnets," describing the application of magnets for separating tramp iron and steel from lead, zinc, copper, silver, and other materials. The bulletin contains a tabulated record, based on the answers to a questionnaire, of the performance rendered by Ohio magnets in actual service.

ELECTRIC EQUIPMENT. Allen - Bradley Co., 1331 S. First St., Milwaukee, Wis. Bulletin 350, illustrating and describing Allen-Bradley alternating- and direct-current drum reverse switches. Bulletin 555, descriptive of Allen-Bradley alternating-current speed regulators. Bulletins 375, 500, 800, 875, and 880, describing, respectively, slip-ring, drum-speed regulators; treadle-operated controllers; push-buttons and accessories; light sources for photo-electric relays; and photo-electric relays.

ELECTRIC WELDERS. Lenney Machine & Mfg. Co., Warren, Ohio. Bulletin entitled "Weld the Standard Way," containing general information on the "Standard" line of spot welders, including instructions for operating; weldable materials; current required; care of welding electrodes and machine; and "Don'ts" for operators. Typical examples showing various methods of spot-welding are shown, and a table of spot-welding data, including time and cost of making welds, is given.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin 959C, decribing a complete line of indoor oil circuit-breakers for moderate- and heavy-duty service at any altitude. Bulletin 1061D, descriptive of recording instruments for both alternating and direct current. Bulletin 1490, dealing with the tandem operation of textile finishing machinery on alternating-current power with GE adjustable-speed, brush-shifting, alternating-current motors and control.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet L-20520, descriptive of the Westinghouse-Wise multi-speed drive, which is a combination of an adjustable speed reducer and a constant-speed induction motor. Leaflet 20516, describing the Westinghouse Type CU single-phase motors which are suitable for application on pumps, compressors, ventilating fans, blowers, farm machinery, and other applications where high starting and high accelerating torques are necessary.

POWER-TRANSMITTING EQUIPMENT. Reeves Pulley Co., Columbus, Ind. Catalogue 99, descriptive of the complete line of Reeves variable-speed transmissions. The first section of the book describes the construction and operating principle; the second section, new designs and remote controls; the third, automatic speed control by electrical and mechanical means; the fourth, standard equipment application; the fifth, specific industrial uses; and the last, engineering information, including charts and diagrams intended to assist manufacturers in applying the Reeves transmission to their own requirements.

TRANSMISSION EQUIPMENT. E.F.Houghton & Co., Philadelphia, Pa. Treatise containing 148 pages of data on Vim short-center drives. This book contains charts, tables, and engineering data on 5000 standard Vim short-center drives ranging from 5 to 100 horsepower. The book was originally published for use by the technical field men of the company to assist them in working out transmission problems with engineers, and therefore is not for general distribution. However, copies will be sent to executives and engineers interested in transmission who send in their requests on the letter-head of the concern with which they are associated.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for October 1, 1931.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Estate of Alexander Luchars; Louis Pelletier; Erik Oberg; Robert B. Luchars; Edgar A. Becker; Laura A. Brownell; and Franklin D. Jones. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

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Sworn to and subscribed before me this 16th day of September, 1931

CHARLES P. ABEL,
Notary Public, Kings County No. 210
(SEAL) Kings Register No. 3011
New York County No. 15, New York Register No. 3-A-6
(My commission expires March 30, 1933)